

COMPUTER SPACE INSTRUCTIONS

1. Check for shipping damage.
2. Check that wires are firmly connected to the TV (see diagram on trouble-shooting guide) and that the grey power plug is connected to the TV circuit board.
3. Plug in the unit and defeat the interlock. (CAUTION: The back of the TV has high voltages.) The panel lights should come on, and after a brief warm-up time the TV screen should show starlit space with two flying saucers moving about.
4. TV Adjustments. The unit has been factory-adjusted but some TV control adjustments may be necessary due to changes caused by vibration in transit. Remember that this is a normal G. E. portable television and is no harder to adjust than any home receiver.

Volume on/off is located on the lower right front of the TV, accessible from the back door with some difficulty. Sound (beeps, missile scream, rocket thrust, and explosions) is on only during game play.

Brightness control is located on the lower center front of the TV and should be adjusted so the background is black and stars and saucers are bright (use a hand mirror to observe results).

Contrast control is located on the lower left front of the TV and should be adjusted for desired star brightness.

Horizontal hold is a white nylon knob on the back of the set at the right. To adjust it, turn on the test pattern switch on the computer box. If diagonal bars are seen, adjust until lock is obtained (the wider the bars are the closer to lock you are). Once in lock, adjust the hook (distortion) out of the top of the TV screen.

Vertical hold is the center long black knob on the back of the TV set and locks the picture from a vertical roll; it can also be used for up/down adjustment.

Vertical size (short knob to right of vertical hold) and vertical lin (short knob to left of vertical hold): These two knobs should be adjusted to make a checker-board pattern of test squares of equal size on all parts of the TV screen.

Once the set is properly adjusted while at operating temperature it should not require further adjustment until the tubes have weakened 75%, a period of time calculated to be about 2 years.

5. Cabinet care. The color is part of the fiberglass and can be restored to new condition through the use of soap and water. Deep scratches may be rubbed out with an abrasive cleanser or fine wet sandpaper. Major repair to the fiberglass may be made with a repair kit sold in most auto shops and Sears stores; Nutting Associates also stocks these repair kits. Major repair seems an unlikely prospect, however, due to the strength and resilience of fiberglass, stronger than wood in both cases.

6. TV maintenance. As a matter of routine, the TV should be removed once a year for screen cleaning. The TV is most easily removed by taking out the four screws connecting the metal brackets to the cabinet back, springing in the brackets and lifting the set out.

7. Brain (computer) unit. The brain unit has three option switches and a time adjustment control which can be changed using a flat blade screwdriver. Because of the extremely high reliability of integrated circuits the brain unit should be considered the least likely source of malfunction in all instances.

GAME OPERATION

Attract mode: Two saucers fly in formation on a star-filled background; sound is off.

Game on: Saucers begin to fire missiles and a rocket image appears. The rocket is equipped with a missile which may be guided after firing using the rotate controls.

Extended play mode: The background becomes white with black numbers, saucers and stars and a black border around the screen. Extended play is awarded if the rocket has made more hits than the saucers at the end of the time limit or if the saucer resets itself.

OPERATING SUGGESTIONS

For hostile locations, space is provided in the bottom of the cabinet for additional weight. Lighter color cabinets (yellow) do slightly better in dark bar type locations, while metalflake colors are better for arcade and well lit spots. If excessive vibration occurs it may become necessary to tape the controls of the TV to keep them from drifting out of adjustment. In no instance has 2/25¢ play increased receipts in test locations.

--//--

It was our object in Computer Space to design an amusement machine which would appeal to adults as well as children. From collection reports around the country we have exceeded our expectations. It was also our object to create a new standard of reliability using the latest technology. We believe that this goal has been met also. Computer Space requires operators to have no more fear of replacing a bad tube than of replacing a bad relay.

If I can help answer any question concerning this machine, please do not hesitate to call me personally.

Nolan K. Bushnell
Chief Engineer
NUTTING ASSOCIATES, Inc.
(415) 961-9373

1. TEST PATTERN ON

- Adjust out top hook
- Vertical centering and size

2. TEST PATTERN OFF, EXTENDED PLAY YES, 2/25¢ YES.

- Brightness just below background illumination
- Contrast for small bright stars
- Volume full
- Tape control knobs

3. REWORK COIN CHUTE.

- Check panel for tight fit
- Run quarter through rejector with plunger depressed several times
- Run coin through and start game; note coin counter
- Check that second game is free

4. INSPECT TO MAKE SURE:

- Wires are tight
- TV bracket is tight
- TV card is taped in
- TV has adequate clearance
- Final settings are:
 - Game time 1.5 min
 - 2/25¢ play NO
 - Test pattern OFF
 - Extended play YES

5. CHECK THAT THE FOLLOWING ARE INCLUDED:

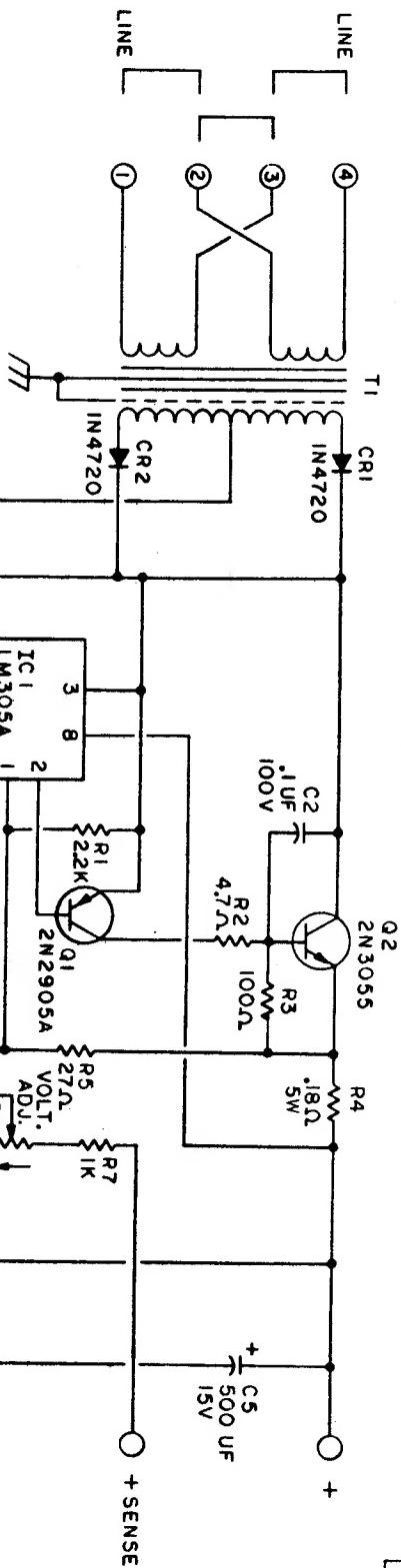
- GE insert
- Trouble-shooting guide
- Instruction sheet

Serial numbers _____
(unit-tube-brain box) (color)

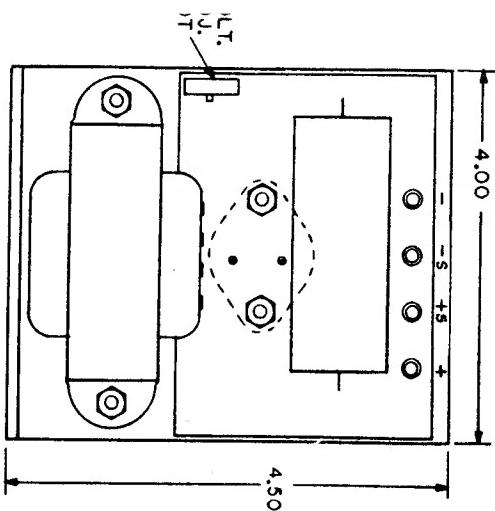
Date _____

Inspected by _____

NOTE: Please write remarks or comments on back of this sheet.



OUTLINE AND MOUNTING DIMENSIONS



SPECIFICATIONS

- CAUTION : READ NOTES BELOW BEFORE OPERATING**
1. FOR 120V OPERATION JUMPER 1 TO 2 AND 3 TO 4 ON T1 ; FOR 240V OPERATION JUMPER 2 TO 3. APPLY LINE POWER TO 1 AND 4
 2. POWER SUPPLY DESIGN ALLOWS FOR CONTINUOUS OPERATION UNDER FULL LOAD AND HIGH LINE CONDITIONS AT 55°C AMBIENT IN FREE AIR ENVIRONMENT. IF AIR FLOW IS RESTRICTED, THE CASE TEMP. OF 2N3055 TRANSISTOR ON HEAT SINK SHOULD BE MONITORED UNDER PARTICULAR WORST CASE CONDITION. MAXIMUM ALLOWABLE TEMP. IS 155°C
 3. CROWBAR FACTORY ADJUSTED AT 6V
 4. **CAUTION :** IF REMOTE SENSING IS NOT DESIRED CONNECT JUMPER BETWEEN + AND +SENSE AND - AND -SENSE TERMINALS. IF REMOTE SENSING IS DESIRED DO NOT INSTALL JUMPERS, BUT CONNECT +SENSE TO + AT LOAD END OF LINE, AND -SENSE TO - AT LOAD END OF LINE.
 5. RECOMMENDED EXTERNAL FUSING : .5A FOR 120V OPERATION .25A FOR 240V OPERATION

LOAD REGULATION : .1%
(0 TO FULL LOAD)
LINE REGULATION : .1% FOR
120/240 ± 10 % (SEE NOTE 1)
NOISE AND RIPPLE : .1%
OVERVOLTAGE PROTECTION
AVAILABLE (SEE NOTE 3)
REMOTE SENSING (SEE NOTE 4)
OPERATING TEMP. : 0 - 55°C
(SEE NOTE 2)

| MODEL | OLV 15 - 5 | REVISED |
|----------------------------------|--------------|---|
| ELEXON INC. SANTA ANA, CALIF. | DATE 2-15-77 | SCALE — APPROVED BY DRAWN BY L.K. REVIEWED |

PRE-INSTALLATION INSPECTION FOR ONE- OR TWO-PLAYER COMPUTER SPACE

1. Check for loose, broken or missing components. Correct if these conditions exist before proceeding further.
2. Check door interlock switch for proper operation.
3. Apply power to unit and check +5VDC power supply for proper voltage level. To insure proper operation of unit the DC voltage level should be set at +5V(± 0.2V)DC.
4. Check whether instruction lights are on. If not, replace lamp(s).
5. Actuate coin switch to check coin counter for proper operation. If coin counter does not advance, check trouble-shooting guide.
6. Apply test pattern to TV and check TV for horizontal and vertical linearity. Adjust if required.
7. Check TV for proper contrast and brightness. Adjust if required.
8. Press start game switch and check operation of unit in single-player mode for proper operation. If not, see trouble-shooting guide.
9. Actuate coin switch again, press two-player select button, then press game start switch. Check unit in two-player mode for proper operation. In this mode of operation at the count of 99 the game should switch to standby operation, which is single-player operation. If not, see trouble-shooting guide.

NUTTING ASSOCIATES, Inc.

April 1973

TWO-PLAYER COMPUTER SPACE TROUBLE-SHOOTING GUIDE

Nutting Associates' Two-Player Computer Space game has been designed for easy servicing by using modular assemblies rather than requiring the repair of discrete components. Servicing is done by "removing and replacing" and does not require a technician trained in electronics.

Computer Space Two-Player is made up essentially of five sub-assemblies: TV set, power supply, computer (brain box), joystick control board (mounted on front panel) and control panel. This is the order in which trouble-shooting should be conducted.

First check the TV adjustments in accordance with numbers 6 and 7 of the preinstallation instructions which came with the game. Once the TV set is properly adjusted it is much easier to check the other components.

Secondly, the power supply should be checked under full load when connected to the computer. The output voltage should be 4.8 to 5.2 volts DC. If it has an AC component or is low in voltage, the power supply should be replaced. Do not attempt power supply repairs; an improperly serviced power supply could damage the computer and cause expensive repairs.

In checking the computer, first check the connections between the printed circuit boards and their respective connectors to make sure that the PC boards are seated properly in the connectors. The PC boards are checked next to see that they have not slipped out of the plastic guides on the computer frame and are not touching each other or the metal frame.

If all the above checks out, then the problem probably centers in the computer. We have designed the computer to be serviced by simply removing the faulty PC board and replacing it with a good board. The faulty board is sent back to the factory for exchange. Exchange repairs are charged only on the basis of necessary repairs, and not for the whole board. When the faulty board is returned it will assist us in repairing it if the failure mode is written on a piece of tape or tag and affixed to the board. If you are unable to isolate the problem, then we recommend that the complete computer be returned to the factory for exchange.

TWO-PLAYER COMPUTER SPACE -- Some Typical Failure Symptoms

Sync Star Board

Purpose: To generate horizontal and vertical scan and sync, generate stars, scoring and time, and control start and stop game functions, explosions.

Typical failure symptoms:

- No or improper timing, count or score
- No game start or continuous game
- No extended play in one-player mode
- No horizontal or vertical hold
- Bad stars
- No collision or missile hits
- Improper explosion sequence
- No two-player mode
- Extended play in two-player mode

Motion Board

Purpose: To generate saucer motion, saucer missile motion and image, saucer direction control, player 1 rocket motion, player 1 rocket missile motion and image, player 2 rocket motion, player 2 rocket missile motion and image, determination of 1 or 2 player operation.

Typical failure symptoms:

- Jerky, excessively fast or jumpy motion of any object
- No images at all
- Missile always in flight
- Distorted rocket image
- No two-player mode
- No one-player mode

A-Memory Board

Purpose: To generate player 1's rocket image, saucer image, rocket rotation, sound generation, +12VDC for sound circuitry, rocket missile directional control, rocket thrust indication, rocket speed command generation, rocket directional control, end of game command.

Typical failure symptoms:

- Odd-shaped rocket or saucer
- Erratic rocket rotation
- No or distorted sound
- Unpredictable rocket missile flight
- Incorrect rocket thrust control
- Continuous game

B-Memory Board

Purpose: Player 2's rocket image generation, rocket rotation, rocket missile directional control, rocket thrust indication, rocket speed command generation, video circuitry, coin counter circuitry.

Typical failure symptoms:

- Odd-shaped rocket
- Erratic rocket rotation
- No or weak video
- Unpredictable rocket missile flight
- Incorrect rocket thrust control
- Coin counter does not advance

Joy Stick Board

Purpose: To generate thrust, rotation and hyperspace commands for each player position.

Typical failure symptoms:

- No thrust
- No rotation in either or both directions
- No hyperspace*

* Defined as the ability of the rocket to disappear.

- 3 -

+5V Power Supply

Purpose: To provide +5VDC to integrated circuits and video circuitry.

Typical failure symptoms: Weak video and any or all of the previously described failure symptoms.

+12VDC Power Supply, located on the A-Memory Board

Purpose: To provide +12VDC audio circuitry and coin counting circuitry.

Typical failure symptoms: No or weak audio and coin counter will not advance.

TWO-PLAYER COMPUTER SPACE
PLAYER CONTROLS

J1 = Sync
J2 = Motion
J3 = "A" Memory
J4 = "B" Memory
JS-2 = Joystick PC bd

| <u>Key</u> | <u>Function</u> | <u>Board/Key</u> | <u>IC/Pin Number</u> |
|------------------|------------------------------|------------------|----------------------------------|
| PLAYER 1: | | | |
| 4 top 6 | CW rotation (right)* | J3 17 | F6-10, E6-5 |
| 3 top 4 | CCW rotation (left)* | J3 18 | E5-4, E6-6 |
| A top 2 | Thrust* | J3 20 | F3-5, 10, 13, sound circuitry |
| | "Missile fire" switch | J2 5 | G1-9, F1-9 |
| PLAYER 2: | | | |
| 13 top 8 | CW rotation (right)* | J4 15 | F6-10, E6-5 |
| M bottom 11 | CCW rotation (left)* | J4 16 | E5-4, E6-6 |
| 10 top 10 | Thrust* | J4 S | F3-5, 10, 13 |
| | "Missile fire" switch | J2 6 | F1-1, G1-12 |
| | 1 or 2 plays for a quarter | J1 8 | B5-4 |
| | Free game | J1 6 | A4-4 |
| | Start switch | J1 4 2 | B6-13 N/O A6-1 N/C |
| | 1- or 2-player select switch | J1 N P | A2-8 Diode Q10 |
| | Coin microswitch | J1 7 | Compac relay, C5-13 |

* JS-2 Joystick PC board.

TWO-PLAYER COMPUTER SPACE
J1 SYNC STAR BOARD OUTPUTS

J2 = Motion Board
J3 = "A" Memory Board
J4 = "B" Memory Board

| Connector Key # | Output | Function | To Board # / Via Key # | / To IC and Pin # |
|-----------------|--------------|---------------------------------|------------------------|--|
| 3 | A5-6 | Audio gate | same J2 J3 | A6-2, B4-5 G3-9 R48, Base Q12 |
| 5 | E4-11 | Normal/Hyper space | J4 | 19 H3-2, 13, J2-2, 3 |
| 9 | C2-12 | Time units/50 | same J3 | B1-11, C5-11 A5-5 |
| 12 | F6-3 | Saucer out and B- rocket enable | same J3 J4 | E6-5, 12 F4-9, C5-2, 10, 11 74151-7 E1-12 |
| 15 | G6-10 | <u>Hyper</u> space | same J4 | H6-9, J6-9 Cathode of "stars" diode |
| 16 | H6-15 | Normal space | same J4 | G6-11 Anode of diode; normal space ckt |
| 17 | B6-3 | <u>Hyper</u> numbers video out | same J4 | G6-13 Cathode of No. diode |
| 18 | G6-12 | <u>Normal</u> numbers video out | J4 | Anode of diode; normal space ckt |
| 20 B | G6-4 F2-2 | Clock out Explosion | J2 J3 | X 26 Through 1K ohm to base Q6 |
| C | C2-1 | Time/10 | same J3 | B1-14, C1-11 A5-4 |
| F | E4-8 | Sync out | J4 | 27 Through 1K ohm to base Q7 |
| H | D4-5 | B- spin | J4 | 17 F6-13 |
| J | E5-11 | Normal missile video | same J4 | C5-1 Anode of diode; normal space |

Two-Player Computer Space
 J1 Sync Star Board Outputs
Page 2

| Connector Key # | Output Key # | Function | To Board # / Via Key # / To IC and Pin # | | |
|--------------------|-------------------|-----------------------------|--|----|---|
| K | C5-2 | <u>Hyper</u> video out | J4 | 22 | Cathode of missile diode |
| L | D4-9 | A- spin | same J3 | 19 | E5-5 F6-13 |
| N | A2-8 | One or Two Player select sw | | | 1- or 2-player select switch |
| P | 1- or 2-player sw | | | | Anode of diode connected to base Q10 |
| R | Collector Q10 | | J2 | 25 | J3-5 |
| T | F6-8 | Rocket enable* | same J3 | 14 | E6-3, 6 Rocket enable |
| U | D3-14 | Blanking out | same J4 | 18 | E5-2, J6-10, F5-6, G5-4, Key V J3-1, H3-1 |
| V | D3-14 | Count enable | same J2 | 18 | E5-2, J6-10, F5-6, G5-4, Key U E2-10, E3-10, E4-10, E5-10 |
| W | E4-3 | Test pattern out | S1 | | Test pattern switch |
| X | E2-1 | Time units/2 | same J3 | K | C1-1, 12 A5-1 |
| Y | E2-12 | Time units/20 | same J3 | L | B1-1, 12 A5-2 |

* Enables rocket after the explosion.

TWO-PLAYER COMPUTER SPACE
J3 "A" MEMORY BOARD OUTPUTS

J1 = Sync Star Board
J2 = Motion Board
J4 = "B" Memory Board

| Connector Key # | Output | Function | To Board # | Via Key # | To IC and Pin # |
|-----------------|--------|--------------------------------------|------------|-----------|------------------------------------|
| 16 | J2-1 | Video out | J4 | N | E5-1 |
| 24 | | Audio out, audio section | | TV audio | |
| P | A5-6 | 1 or 2, literally, reset | J2 | AA | G4-1 |
| T | F5-4 | Missile up/down enable | J2 | 8 | F3-12, C3-3 |
| U | F5-1 | Missile left/right enable | J2 | 9 | F3-9, E3-3 |
| V | H5-11 | 2^1 , A-vertical velocity* | same J2 | DD | H6-4, 10 H4-13 |
| W | H5-6 | 2^0 , A-vertical velocity* | same J2 | 21 | H6-2, 12 H4-3 |
| X | H5-3 | 2^2 , A-vertical velocity* | same J2 | 22 | H6-1, 13 H4-10 |
| Y | H4-7 | Up/down, A-vertical velocity | same J2 | W | H5-1, 4, 13, H6-5, H2-1 F5-5 |
| Z | J5-8 | Missile up/down | same J2 | 10 | H3-5, H2-13 F3-11 |
| AA | J5-11 | Up/down thrust, A-speed 2^1 * | same J2 | 19 | J6-4, 10 J4-13 |
| BB | J5-6 | Up/down thrust, A-speed 2^0 * | same J2 | 20 | J6-2, 12 J4-3 |
| CC | J5-3 | Up/down thrust, A-speed 2^2 * | same J2 | 23 | J6-1, 13 J4-10 |
| DD | J4-7 | Right/left, A-horizontal velocity | same J2 | V | J5-1, 4, 13, J6-5, H2-3 F5-3 |
| EE | E3-14 | Missile right/left | same J2 | 11 | J3-5 F3-8 |

* Because of the different directions the rocket may take, left/right and up/down signals may appear at horizontal as well as vertical velocity circuits.

TWO-PLAYER COMPUTER SPACE
J4 "B" MEMORY BOARD OUTPUTS

J1 = Sync Star Board
 J2 = Motion Board
 J3 = "A" Memory Board

| Connector Key # | Output | Function | To Board # / Via Key # / To IC and Pin # | | |
|--------------------|------------|--------------------------------------|--|----------|--------------------|
| 5 | E1-13 | Rocket video | same | 6 | C4-2 |
| 28 | Emitter Q8 | Video out thru 10 ohm resistor | | TV Video | |
| P | E6-1 | Rocket "B" turn sounds | J3 | 15 | Audio section |
| T | F5-4 | Missile "B" up/down enable | J2 | 1 | A1-11 |
| U | F5-1 | Missile "B" right/left enable | J2 | 4 | A1-2 |
| V | H5-11 | 2^1 , B vertical velocity* | same | | H6-4, 10 |
| | | | J2 | 13 | H5-13 |
| W | H5-6 | 2^0 , B vertical velocity* | same | | H6-2, 12 |
| | | | J2 | 14 | H5-3 |
| X | H5-3 | 2^2 , B vertical velocity* | same | | H6-1, 13 |
| | | | J2 | 17 | H5-10 |
| Y | H4-7 | B up/down | same | | H5-1, 4, 13, H6-5 |
| | | | J2 | Z | H2-1 |
| | | | | | G5-2 |
| Z | J5-8 | Missile up/down | same | | H3-5, H2-13 |
| | | | J2 | 3 | A1-14 |
| AA | J5-11 | Up/down thrust, speed 2^1 , B* | same | | J6-4, 10 |
| | | | J2 | EE | J5-13 |
| BB | J5-6 | Up/down thrust, speed 2^0 , B* | J2 | 15 | J5-3 |
| CC | J5-3 | Up/down thrust, speed 2^2 , B* | same | | J6-1, 13 |
| | | | J2 | 16 | J5-10 |
| DD | J4-7 | Right/left | same | | J5-1, 4, 13, J6-5, |
| | | | | | H2-3 |
| EE | E3-14 | Missile right/left | J2 | CC | G5-11 |
| | | | same | | J3-5, E3-14 |
| | | | J2 | 2 | A1-5 |

* Because of the different directions the rocket may take, left/right and up/down signals may appear at horizontal as well as vertical velocity circuits.

TWO-PLAYER COMPUTER SPACE
J2 MOTION BOARD OUTPUTS

J1 = Sync star board
J3 = "A" Memory board
J4 = "B" Memory board

| Connector Output Key # | Function | To Board # / Via Key # / To IC and Pin # | | |
|---------------------------|--|--|---------|---|
| 7 | B3-15 Rocket missile video | same J1 | 14 | F3-2, 3 F6-5 |
| 12 | A4-8 "A" rocket enable | same J1 | 10 | J3-13 E6-9 |
| 24 | J3-10 Sync | same J1 | 13 | H1-4 F6-1 |
| 26 | B2-15 B- missile video | same J1 | 11 | J3-9 F6-13 |
| 27 | H2-15 Saucer movement | same J4 J3 | R S | G3-2, 5, J2-4, 10 J1-3, H2-6 F6-4 F6-4 |
| 28* | G1-6 and Missile sound out F3-4 | J3 | 22 | Audio section |
| B | D4-11 Vertical counts, "A" rocket enable | same J3 | D | J1-6 A6-6, 11 |
| C | D4-12 Vertical counts, "A" rocket enable | J3 | E | B6-6, 11 |
| D | D4-13 Vertical counts, "A" rocket enable | J3 | 8 | C6-6, 11 |
| E | D4-14 Vertical counts, "A" rocket enable | J3 | 13 | D6-6, 11 |
| F | D5-11 Vertical counts, "B" rocket enable | same J3 J4 | 4 D | J1-8, E1-10 A6-3, 12 A6-6, 11 |
| H | D5-12 Vertical counts, "B" rocket enable | J3 J4 | H 8 | B6-3, 12, E6-12 B6-6, 11, E6-12 |
| J | D5-14 Vertical counts, "B" rocket enable | J3 J4 | 10 L | D6-3, 12 E4-11, J1-5 |

* See schematic; outputs are common, through appropriate circuitry, for missile sound output.

Two-Player Computer Space

J2 Motion Board Outputs

Page 2

| <u>Connector Key #</u> | <u>Output</u> | <u>Function</u> | <u>To Board # / Via Key # / To IC and Pin #</u> | | |
|------------------------|---------------|--------------------------------------|---|--------------|---|
| K | D5-13 | Vertical counts, "B" rocket enable | J3 J4 | R J | C6-3, 12 C6-6, 11 |
| L | E4-11 | Horizontal counts, "A" rocket enable | same J3 | C | J1-5 A6-5, 10 |
| M | E4-12 | Horizontal counts, "A" rocket enable | J3 | J | B6-5, 10 |
| N | E4-13 | Horizontal counts, "A" rocket enable | J3 | 7 | C6-5, 10, and through diode to 74151-15 |
| P | E4-14 | Horizontal counts, "A" rocket enable | J3 | 12 | D6-5, 10 |
| R | E5-11 | Horizontal counts, "B" rocket enable | same J3 J4 | 5 C | J1-9 A6-4, 13 A6-5, 10 |
| S | E5-12 | Horizontal counts, "B" rocket enable | J3 J4 | F 7 | B6-4, 13 B6-5, 10 |
| T | E5-14 | Horizontal counts, "B" rocket enable | same J3 J4 | 11 14 | H3-3 D6-4, 13 D6-5, 10 |
| U | E5-13 | Horizontal counts, "B" rocket enable | J3 J4 | 6 H | C6-4, 13 C6-6, 11 |
| BB | G4-6 | 1 or 2, literally | same J1 J3 J4 | D 21 9 | G5-1, E1-1, A1-1 D5-5, 6 J3-2 H2-9 |

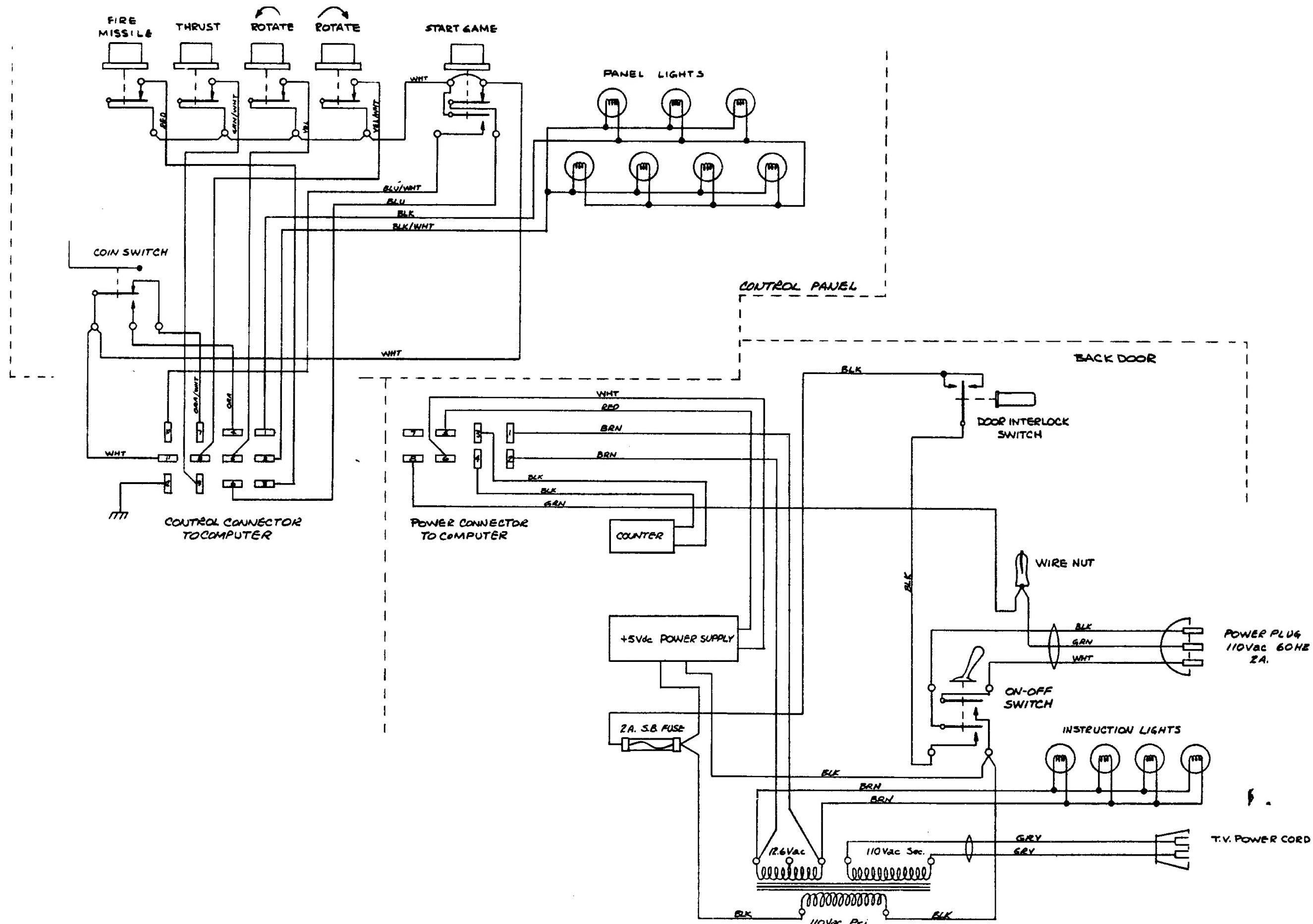
TWO - PLAYER CHASSIS WIRING

8-PIN MOLEX

| <u>PIN</u> | <u>WIRE</u> | <u>PURPOSE</u> |
|------------|-------------|-----------------|
| 1 | Blk | 12 vac |
| 2 | Blk | 12 vac |
| 3 | Brn | coin counter |
| 4 | Brn | coin counter |
| 5 | Red | +5 VDC |
| 6 | Wht | common (signal) |
| 7 | NC | |
| 8 | NC | |

24-PIN MOLEX FROM FRONT PANEL TO BRAIN BOX

| <u>PIN</u> | <u>WIRE</u> | <u>PURPOSE</u> |
|------------|-------------|-------------------------------------|
| 1 | NC | |
| 2 | NC | |
| 3 | Blk | Player 1 missle fire |
| 4 | Wht | NO side coin switch |
| 5 | Blu | Player 1 counter-clockwise rotation |
| 6 | Grn | NC side start game switch |
| 7 | Blk | NC side coin switch |
| 8 | Blk | Player 1 clockwise rotation |
| 9 | Blk | Player 1 thrust |
| 10 | Yl | NO side start game switch |
| 11 | NC | |
| 12 | NC | |
| 13 | NC | |
| 14 | NC | |
| 15 | Blk | Player 2 Clockwise rotation |
| 16 | Or | Player 2 counter-clockwise rotation |
| 17 | Red | Player 2 missle fire |
| 18 | Wht | Player 2 thrust |
| 19 | Red | Com side 2 player select switch |
| 20 | Grn | Common (signal) |
| 21 | Red | NO side 2 player select switch |
| 22 | Blu | +5 VDC |
| 23 | NC | |
| 24 | NC | |



CONTROL & POWER CHASSIS WIRING,
COMPUTER SPACE
DRAWN BY TED DABNEY
NUTTING ASSOC. MNT. VIEW, CALIF

J1
POWER

| | |
|-----|-------------------------|
| 1 | J5-Y J2-Y |
| 2 | J5-W J2-W |
| ① 3 | J5-16 |
| 4 | J5-19 |
| 5 | J3-Z |
| 6 | J3-11 J5-S J5-1 J2-B |
| 7 | |
| 8 | J2-12 |

J2
CONTROL

| | |
|----|-------|
| 1 | J1-1 |
| 2 | J1-2 |
| 3 | J4-Y |
| 4 | J5-C |
| 5 | J3-N |
| 6 | J5-B |
| 7 | J5-21 |
| 8 | J3-M |
| 9 | J3-S |
| 10 | J5-7 |
| 11 | J1-6 |
| 12 | J1-8 |

COUNTER CHANGE

J3
MEMORY

| | | | |
|--------|----|---|---------------|
| J1-6 | 1 | A | J4-8 |
| J4-K | 2 | B | J4-6 |
| J4-F | 3 | C | J4-12 |
| J4-N | 4 | D | J4-15 |
| J4-13 | 5 | E | J4-9 |
| J4-L | 6 | F | J4-5 |
| J4-E | 7 | H | J4-11 |
| J4-M | 8 | J | J4-R |
| J4-14 | 9 | K | J5-2 |
| J5-5 | 10 | L | |
| J4-B | 11 | M | J2-8 |
| J4-18 | 12 | N | J2-5 |
| J4-D | 13 | P | J5-N |
| J4-3 | 14 | R | J5-M |
| J4-4 | 15 | S | J2-9 |
| J4-J | 16 | T | J4-19 |
| J4-16 | 17 | U | J4-17 |
| J4-2 | 18 | V | J4-U |
| J5-K | 19 | W | J4-T |
| TV-AUD | 20 | X | J4-Y |
| J5-X | 21 | Y | J4-H |
| J5-L | 22 | Z | J1-5 J4-22 |

J4
MOTION

| | | | |
|-------|----|-----|-------|
| J3-1 | 1 | → A | J5-1 |
| J3-18 | 2 | B | J3-11 |
| J3-14 | 3 | C | J5-H |
| J3-15 | 4 | D | J3-13 |
| J3-F | 5 | E | J3-7 |
| J3-B | 6 | F | J3-3 |
| | 7 | H | J3-Y |
| J3-A | 8 | J | J3-16 |
| J3-E | 9 | K | J3-2 |
| J5-4 | 10 | L | J3-6 |
| J3-H | 11 | M | J3-8 |
| J3-C | 12 | N | J3-4 |
| J3-S | 13 | P | J5-6 |
| J3-9 | 14 | R | J3-J |
| J3-D | 15 | S | |
| J3-17 | 16 | T | J3-W |
| J3-U | 17 | U | J3-V |
| J3-12 | 18 | V | J3-X |
| J3-T | 19 | W | J5-E |
| J5-Y | 20 | X | |
| J5-3 | 21 | Y | J2-3 |
| J3-Z | 22 | → Z | J5-22 |

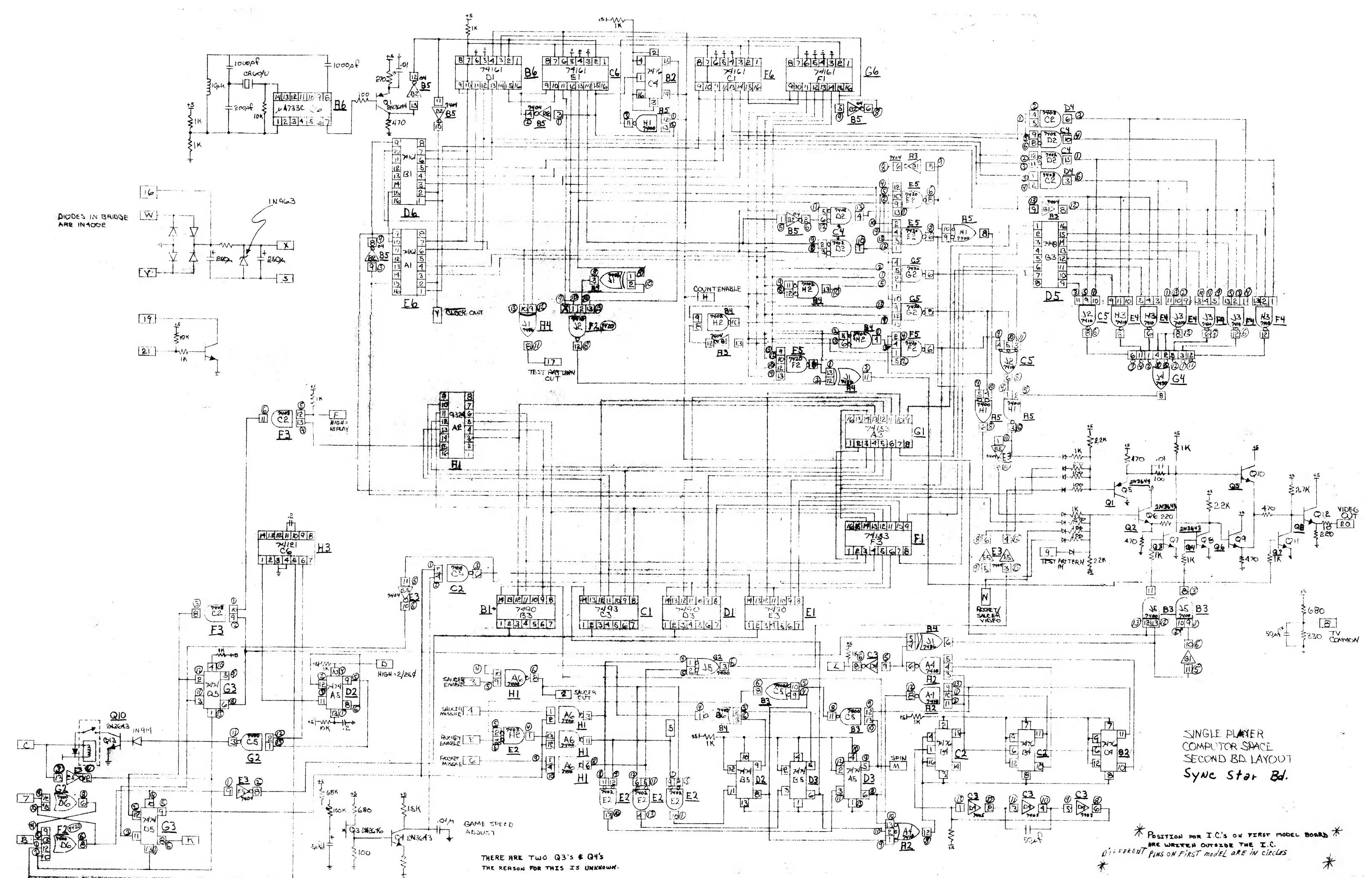
J5
SYNC

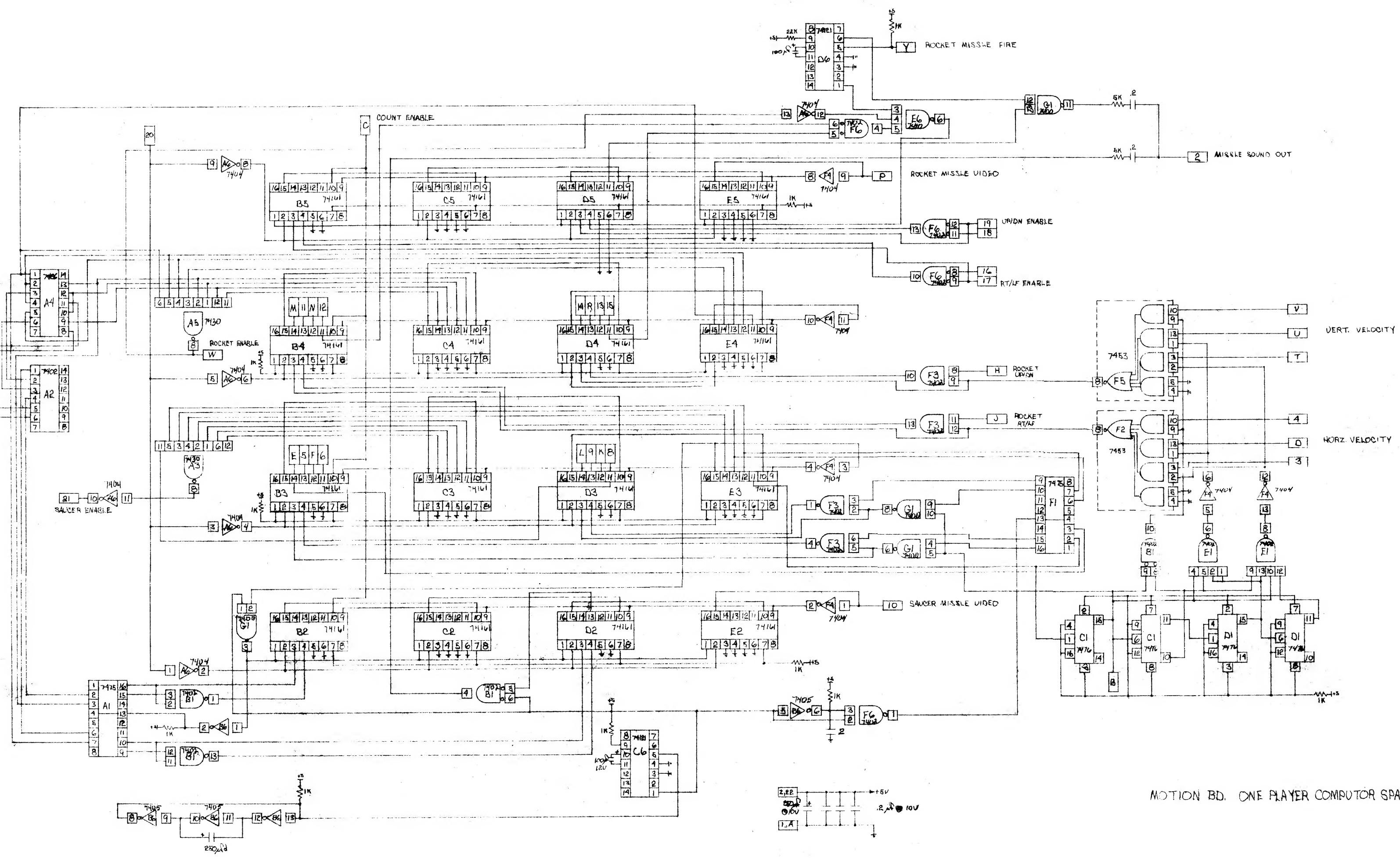
| | | | |
|--------|----|-----|-------|
| J4-A | 1 | → A | J5-S |
| J3-K | 2 | B | J2-6 |
| J4-21 | 3 | C | J2-4 |
| J4-10 | 4 | D | S7-C |
| J3-10 | 5 | E | J4-W |
| J4-P | 6 | F | S6-A |
| J2-10 | 7 | H | J4-C |
| TV-COM | 8 | J | |
| S8-B | 9 | K | J3-19 |
| | 10 | L | J3-22 |
| | 11 | M | J3-R |
| | 12 | N | J3-P |
| | 13 | P | |
| | 14 | R | |
| | 15 | S | S7-B |
| ① J1-3 | 16 | T | |
| S8-A | 17 | U | |
| | 18 | V | J1-1 |
| J1-4 | 19 | W | J1-2 |
| TV-VID | 20 | X | J3-21 |
| J2-7 | 21 | Y | J4-20 |
| J4-Z | 22 | → Z | |

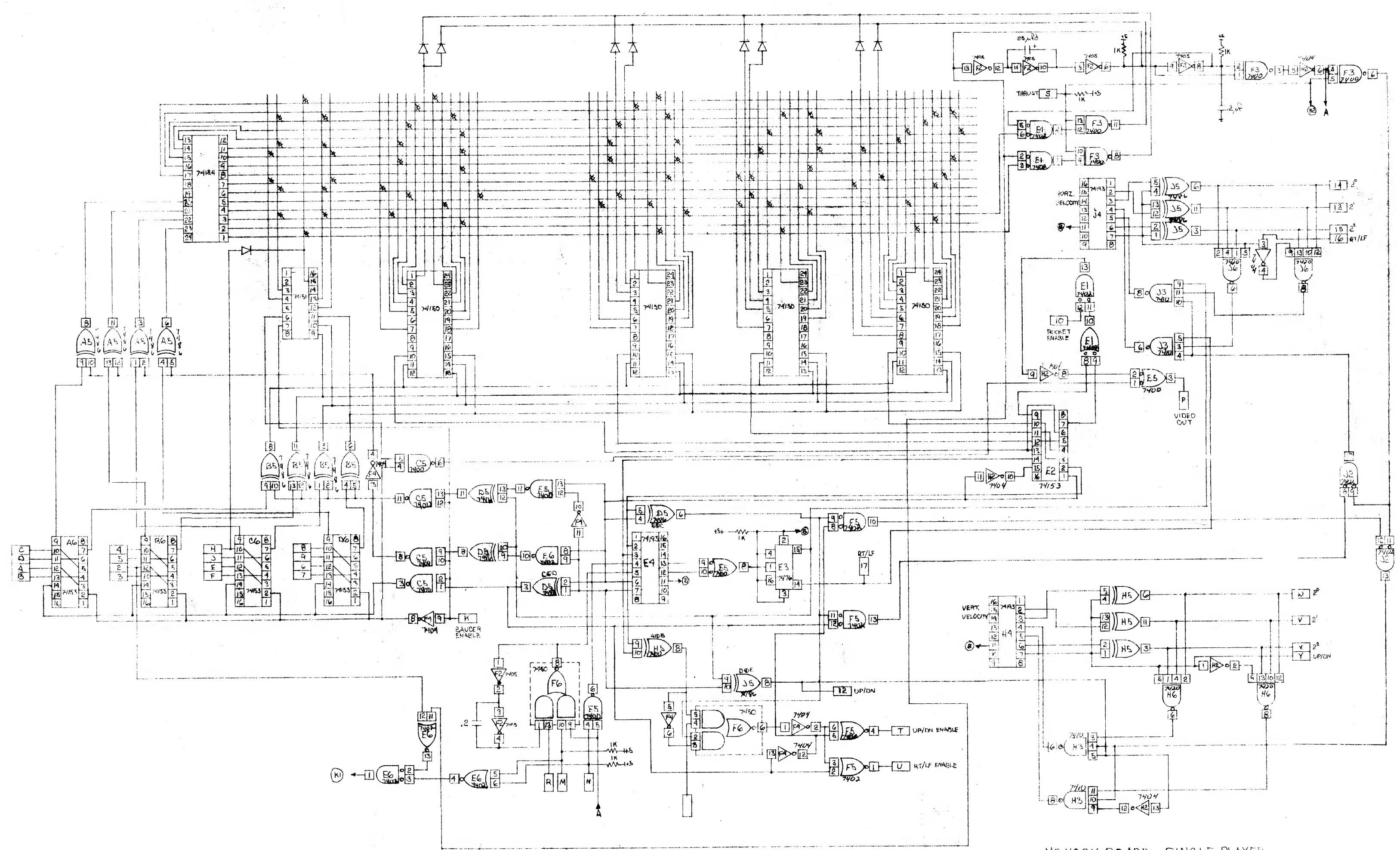
NA -

SINGLE PLAYER COMPUTER SPACE
CONNECTOR INTERCONNECTIONS

NOV 23, 1971 SKD -

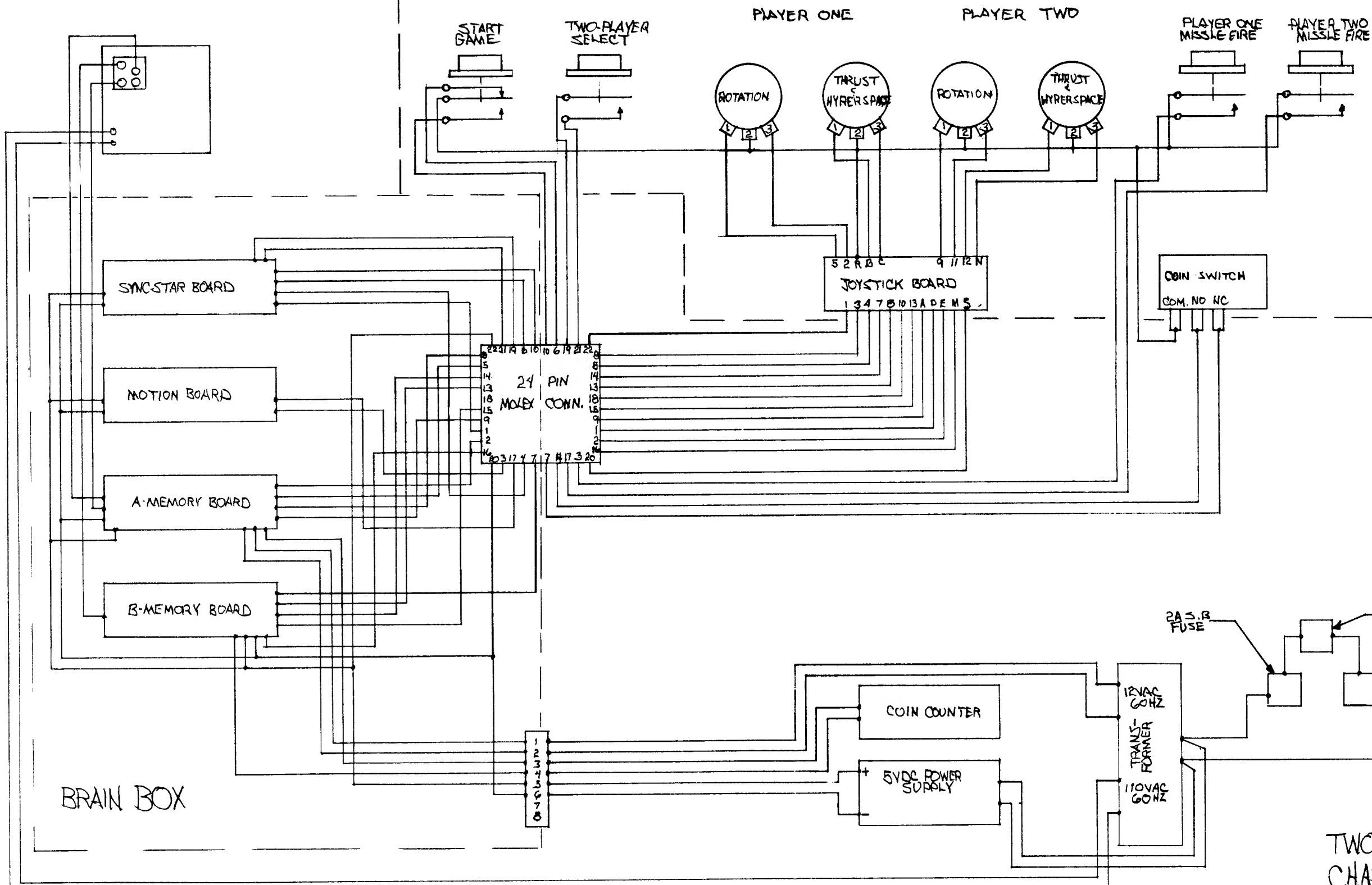






MEMORY BOARD SINGLE-PLAYER
COMPUTER SPACE

FRONT PANEL



TWO-PLAYER COMPUTER SPACE
CHASSIS WIRING

DRAWN BY: WALTER ANDERSON 5/1/73
NUTTING ASSOC. INC.
MT. VIEW, CA 94031

J1
SYNC-STA

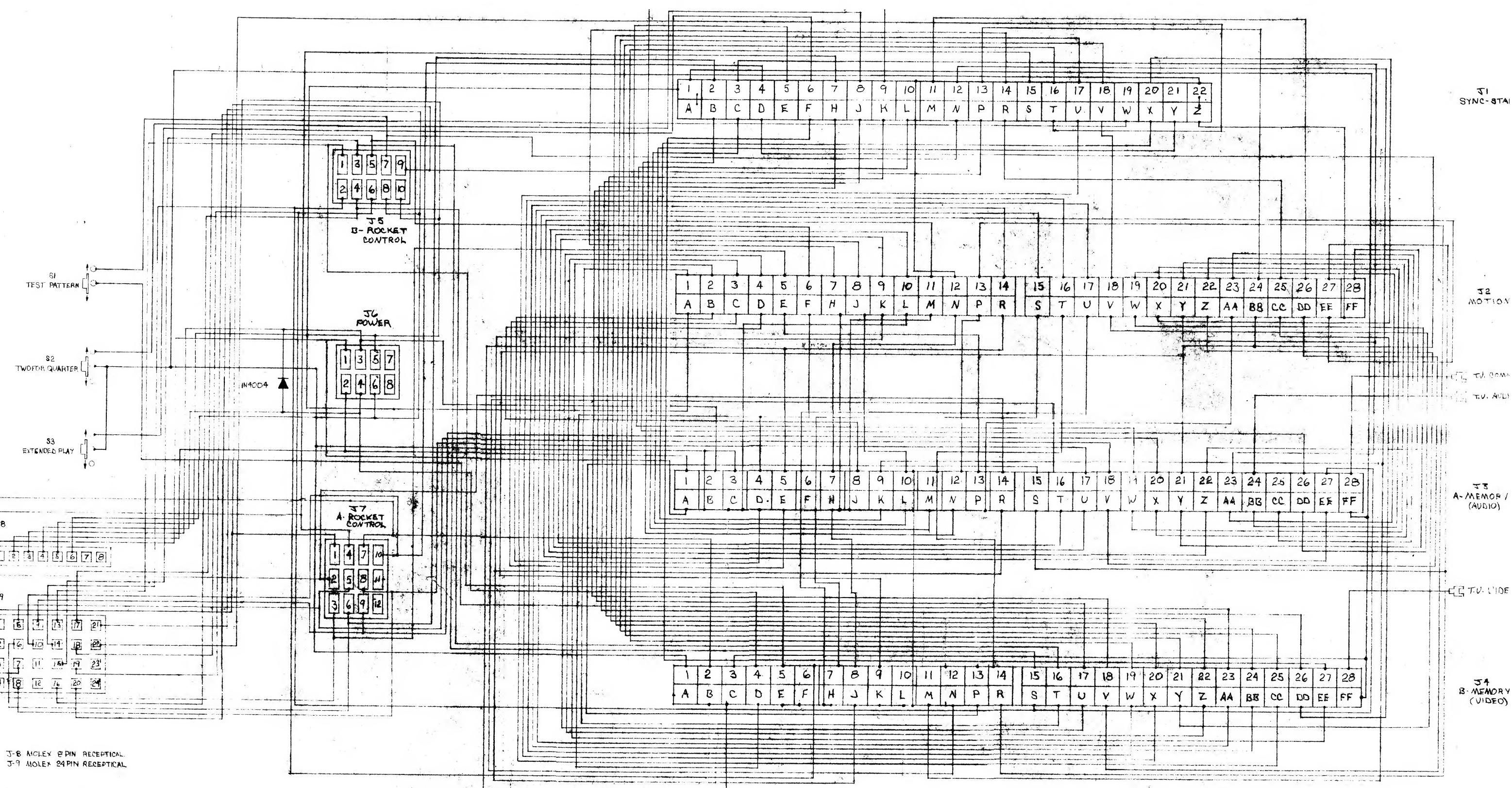
J2
MOTION

J5
T.V. COMA
T.V. AUDI

J3
A-MEMOR /
(AUDIO)

J6
T.V. VIDEO

J4
B-MEMORY
(VIDEO)



J-8 MOLEX 8 PIN RECEPTICAL
J-9 MOLEX 24 PIN RECEPTICAL

IRING:

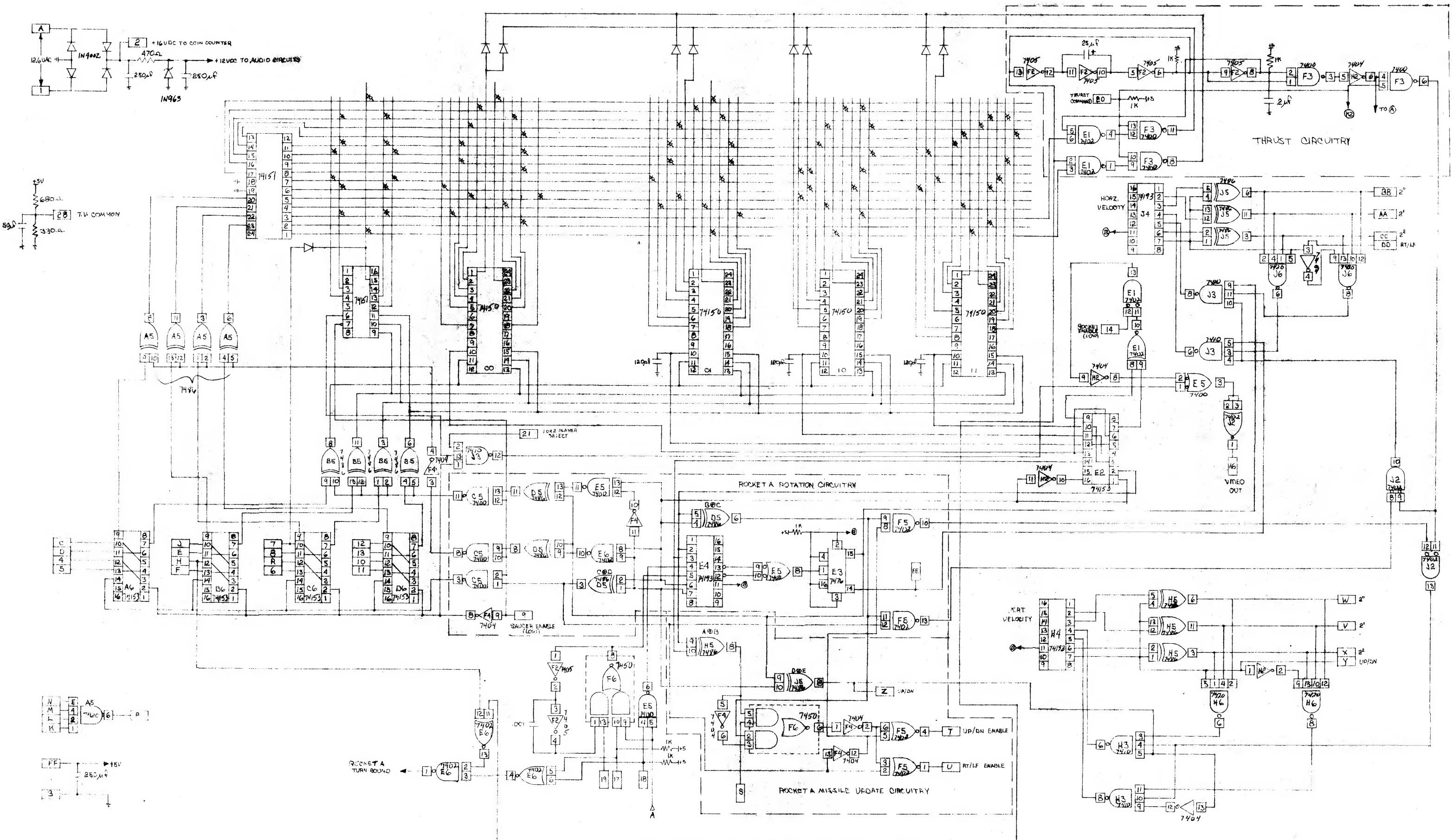
J8 PIN
1-BLACK 22 GAUGE
2-BLACK 22 GAUGE
3-BROWN 22 GAUGE
4-BROWN 22 GAUGE
5-RED 18 GAUGE
6-WHITE 18 GAUGE
7-N.C.
8-N.C.

J9 PIN
1-BLACK 22 GAUGE
2-OR/WHT 22 GAUGE
3-YL/WHT 22 GAUGE
4-VIO/WHT 22 GAUGE
5-GRN/WHT 22 GAUGE
6-BLK/WHT 22 GAUGE
7-BLU 22 GAUGE
8-YL 22 GAUGE
9-OR 22 GAUGE
10-BL/WHT 22 GAUGE
11-N.C.
12-N.C.

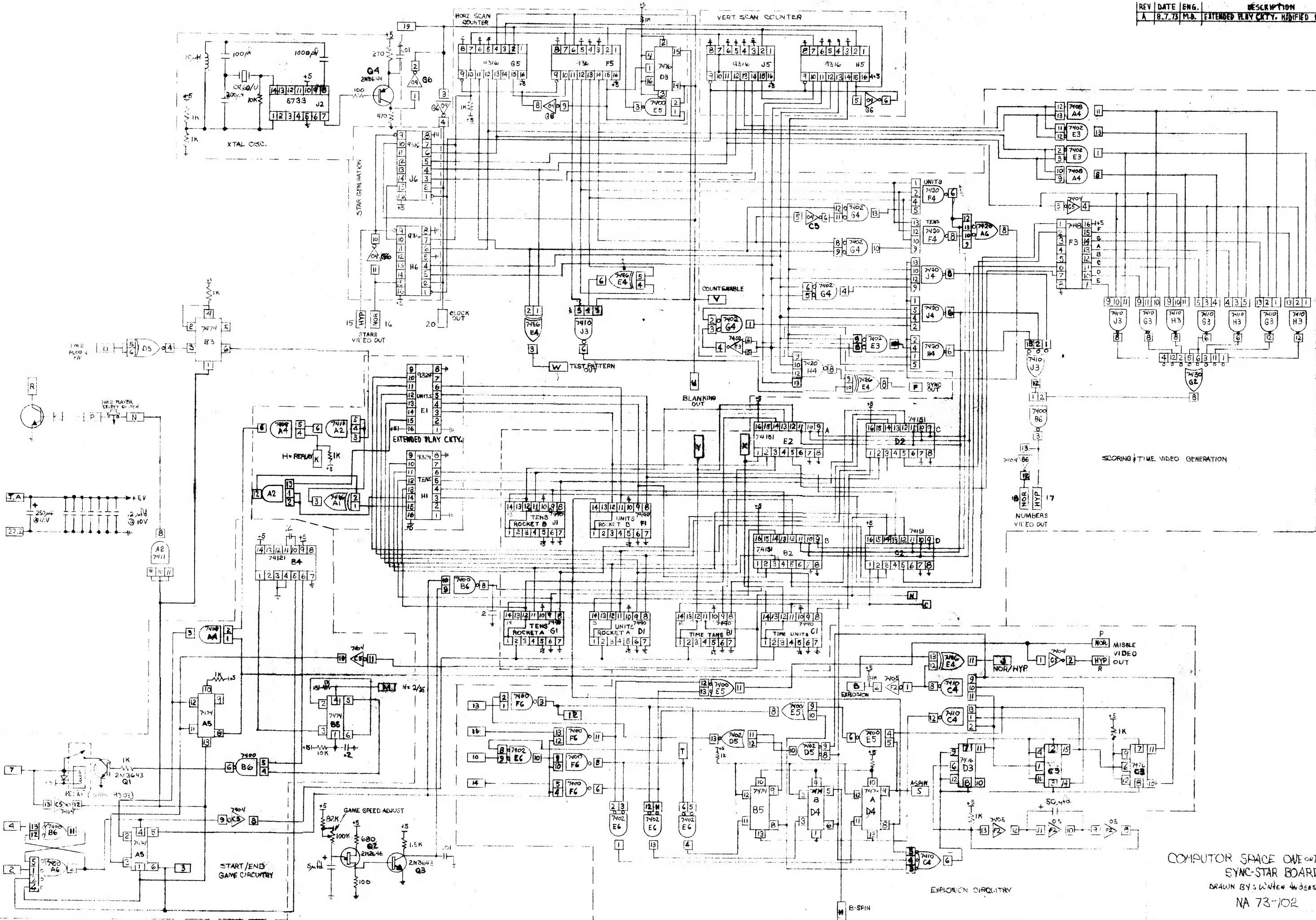
1-BL/WHT 22 GAUGE
2-OR/WHT 22 GAUGE
3-VIO/WHT 22 GAUGE
4-GRY/WHT 22 GAUGE
5-BLD 22 GAUGE
6-WHT 22 GAUGE
7-OR 22 GAUGE
8-GRN/WHT 22 GAUGE
9-BLU 22 GAUGE
10-BL/WHT 22 GAUGE
11-N.C.
12-N.C.

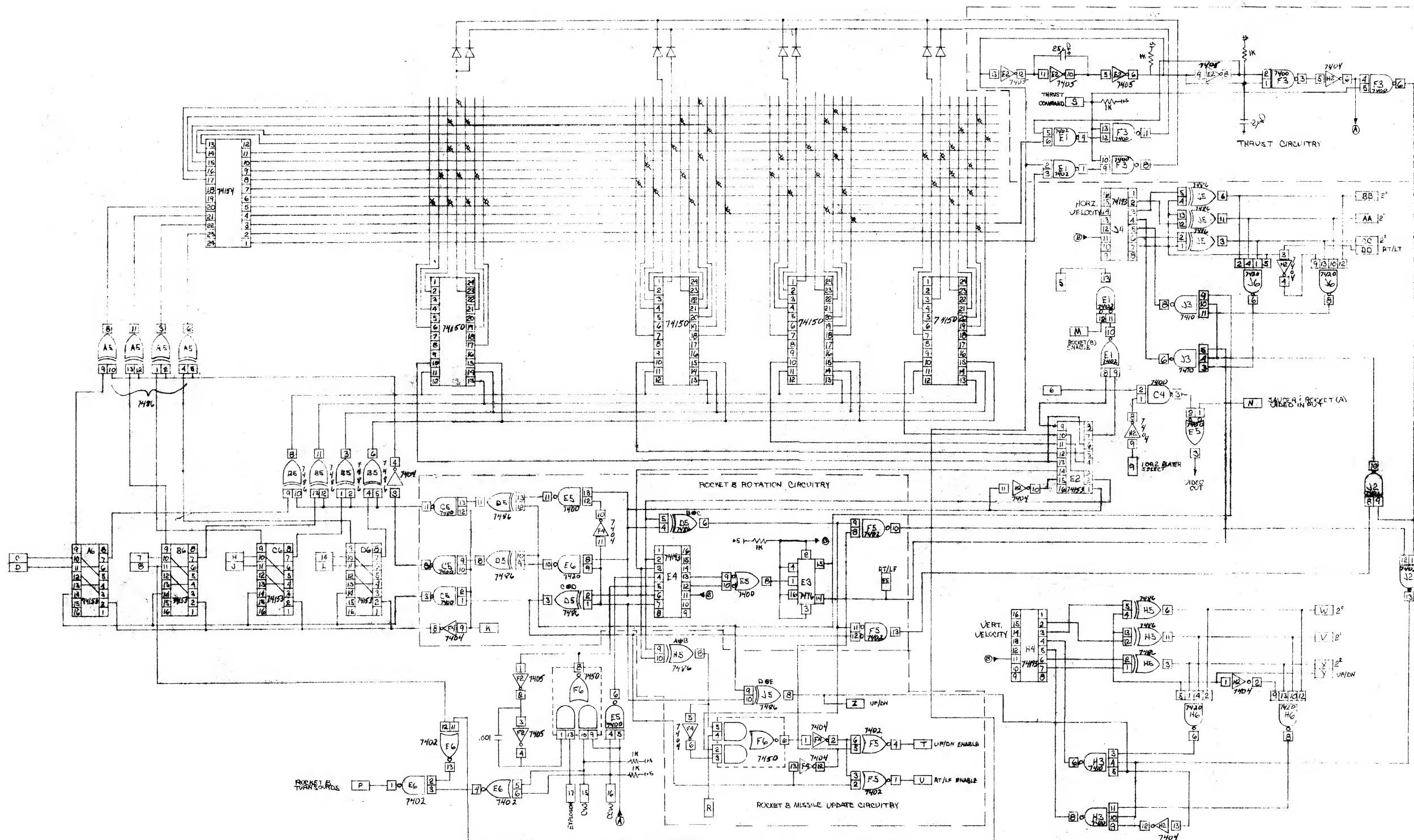
BRAIN BOX WIRING DIAGRAM - TWO PLAYER COMPUTER SPACE
BRAIN BYS WALTER ANDERSON 11/29/72

NA 73-124



A-MEMORY BOARD (AUDIO) NA 73-100
1 OR 2 PLAYER COMPUTER SPACE
DRAWN BY: WALTER ANDERSON 1/26/73

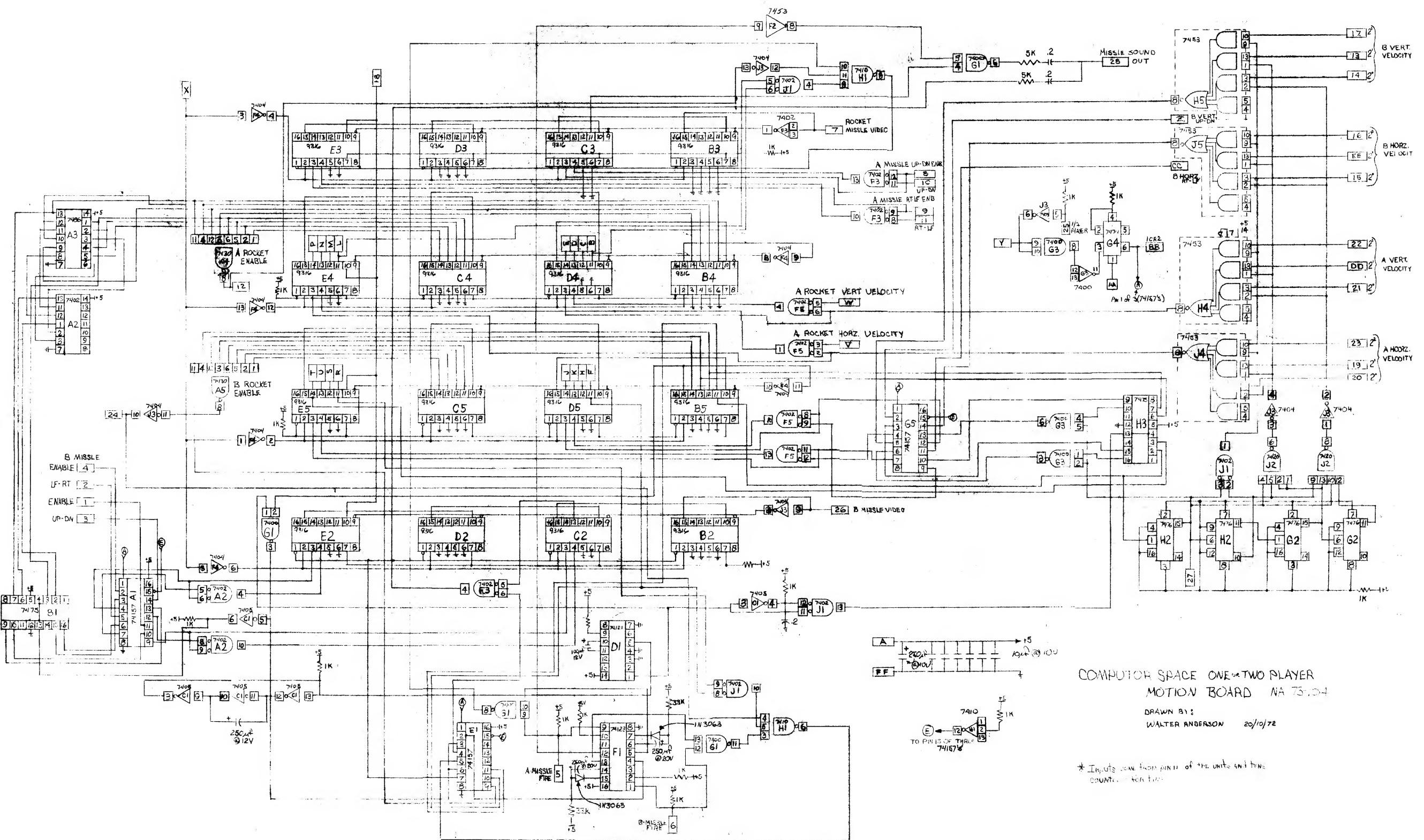




B-MEMORY 1 OR 2 PLAYER NA 73-1C2

COMPUTER SPACE

DRAWN BY: WALTER ANDERSON

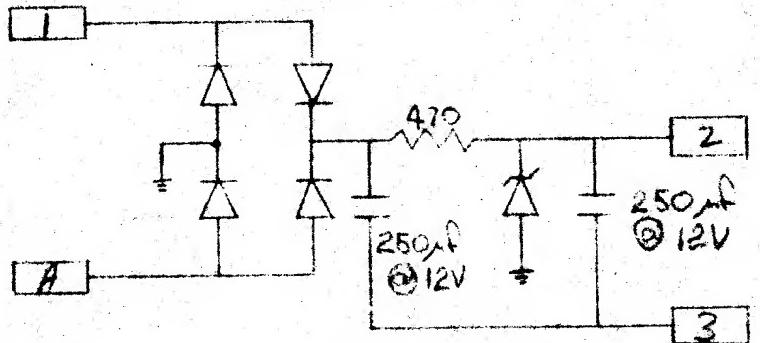


COMPUTOR SPACE ONE or TWO PLAYER
MOTION BOARD NA 73-04

DRAWN BY:
WALTER ANDERSON 20/10/72

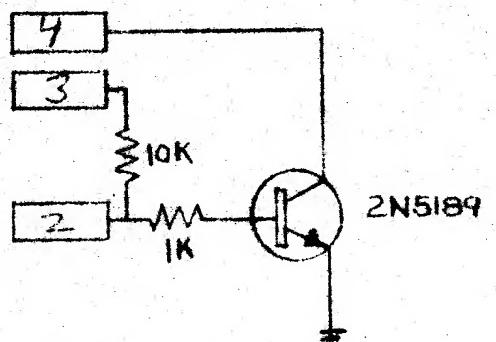
A - MEMORY - 2 PLAYER

BRIDGE DIODES - IN4002
ZENER - IN963

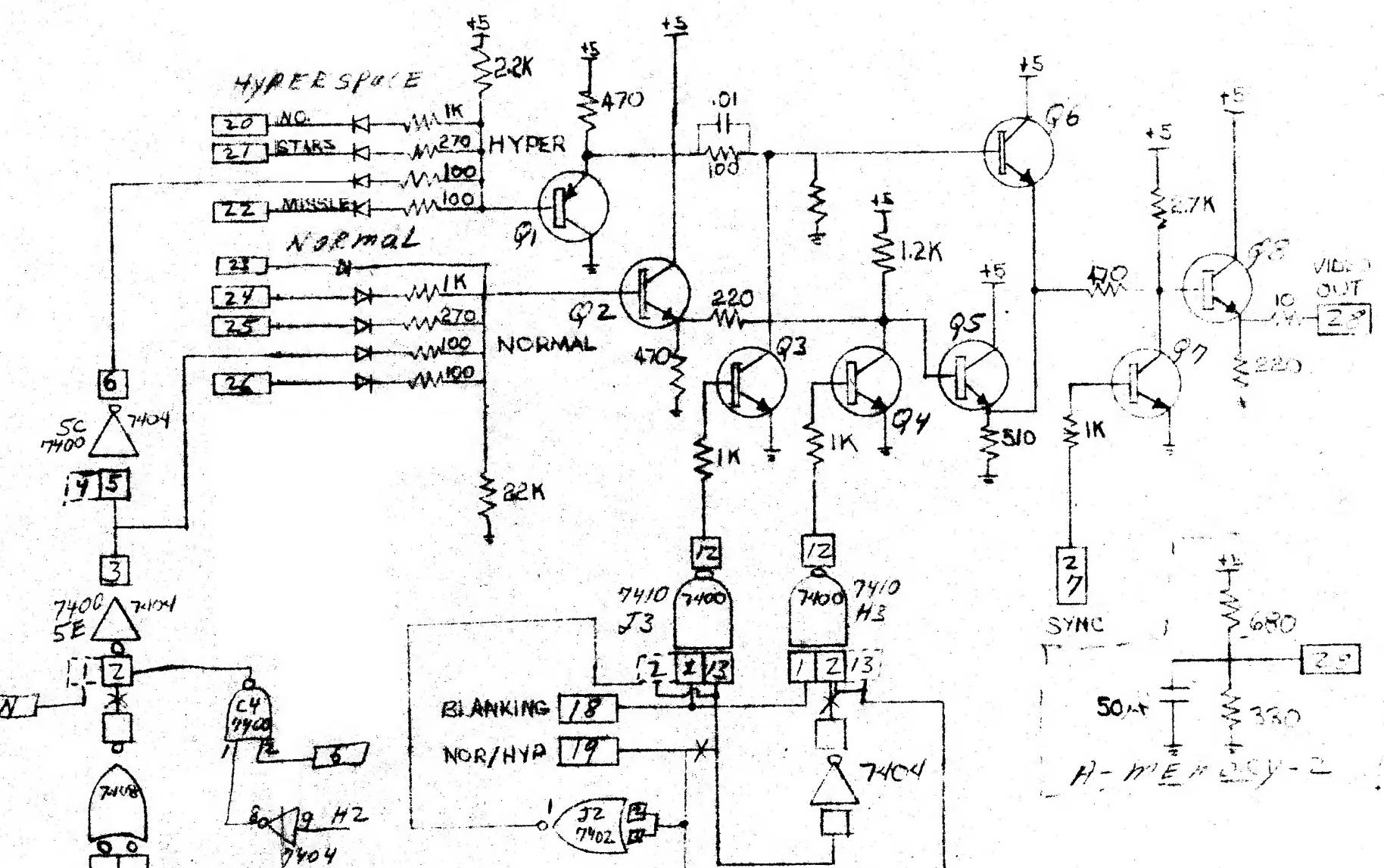


12VDC POWER SUPPLY

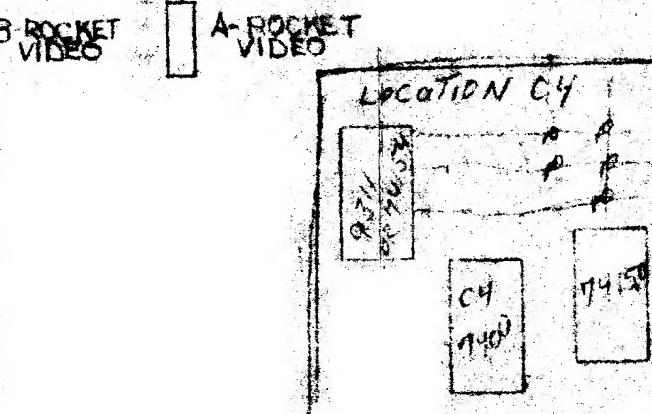
B - MEMORY - 2 PLAYER



COIN
COUNTER



VIDEO AMPLIFIER B - MEMORY - 2 PLAYER
NA 73-121 (PART OF 2-PLAYER SYNC RD.)
was

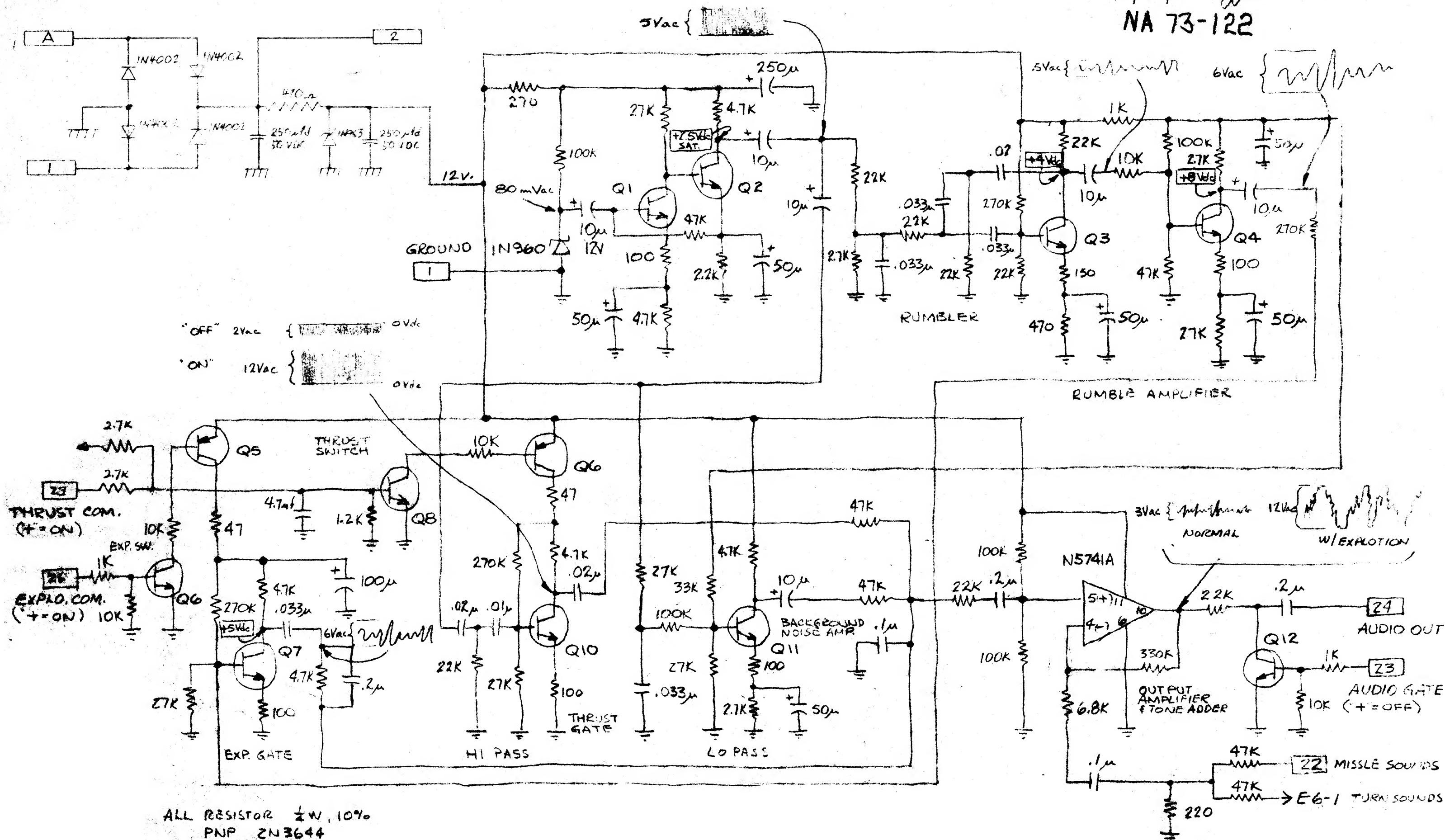


NOTE: THIS DWG IS PART OF A-MEMORY BOARD (2-PLAYER C.S.)

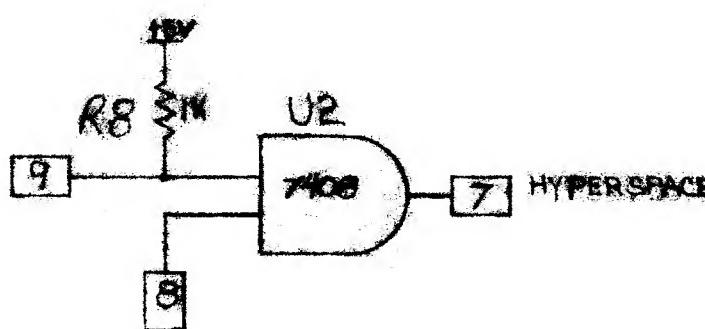
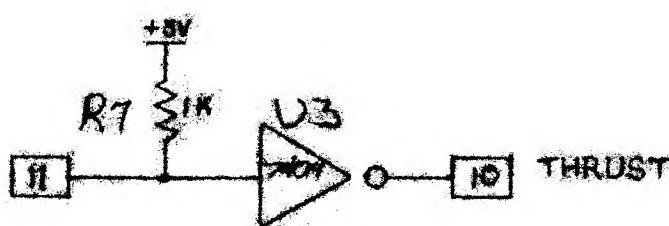
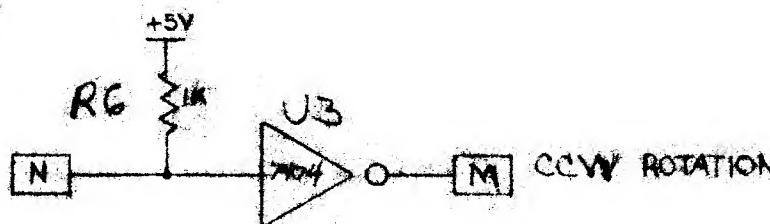
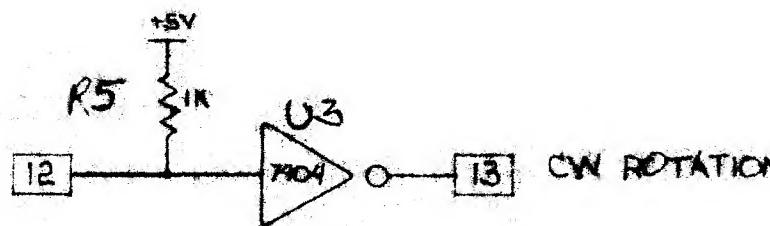
COMPUTER SPACE SOUND CIRCUITS
A-MEMORY BOARD (2-PLAYER CS)

10/27/71 - 8/3/73 UPDATED KIT

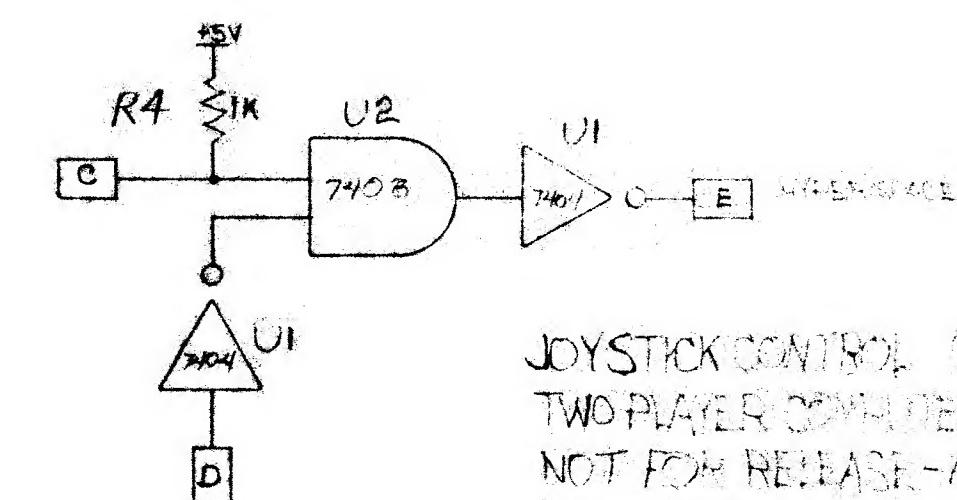
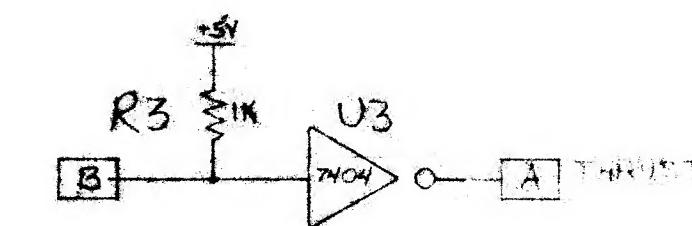
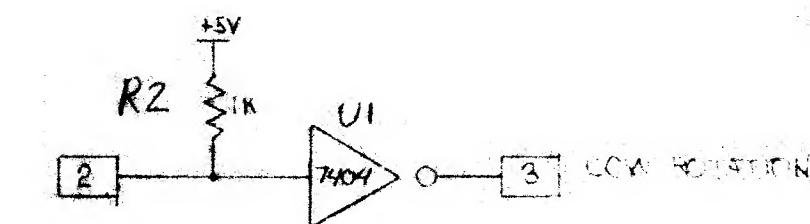
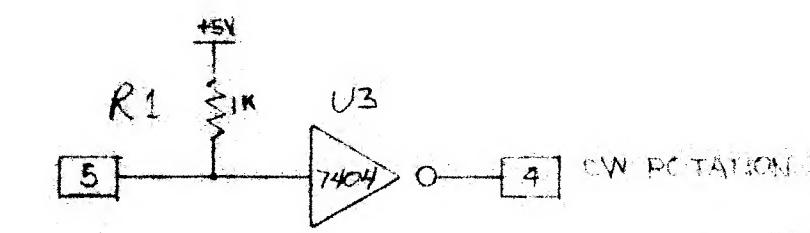
NA 73-122



PLAYER TWO



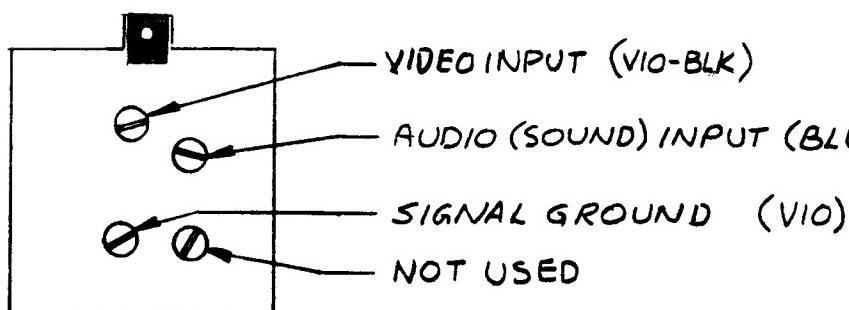
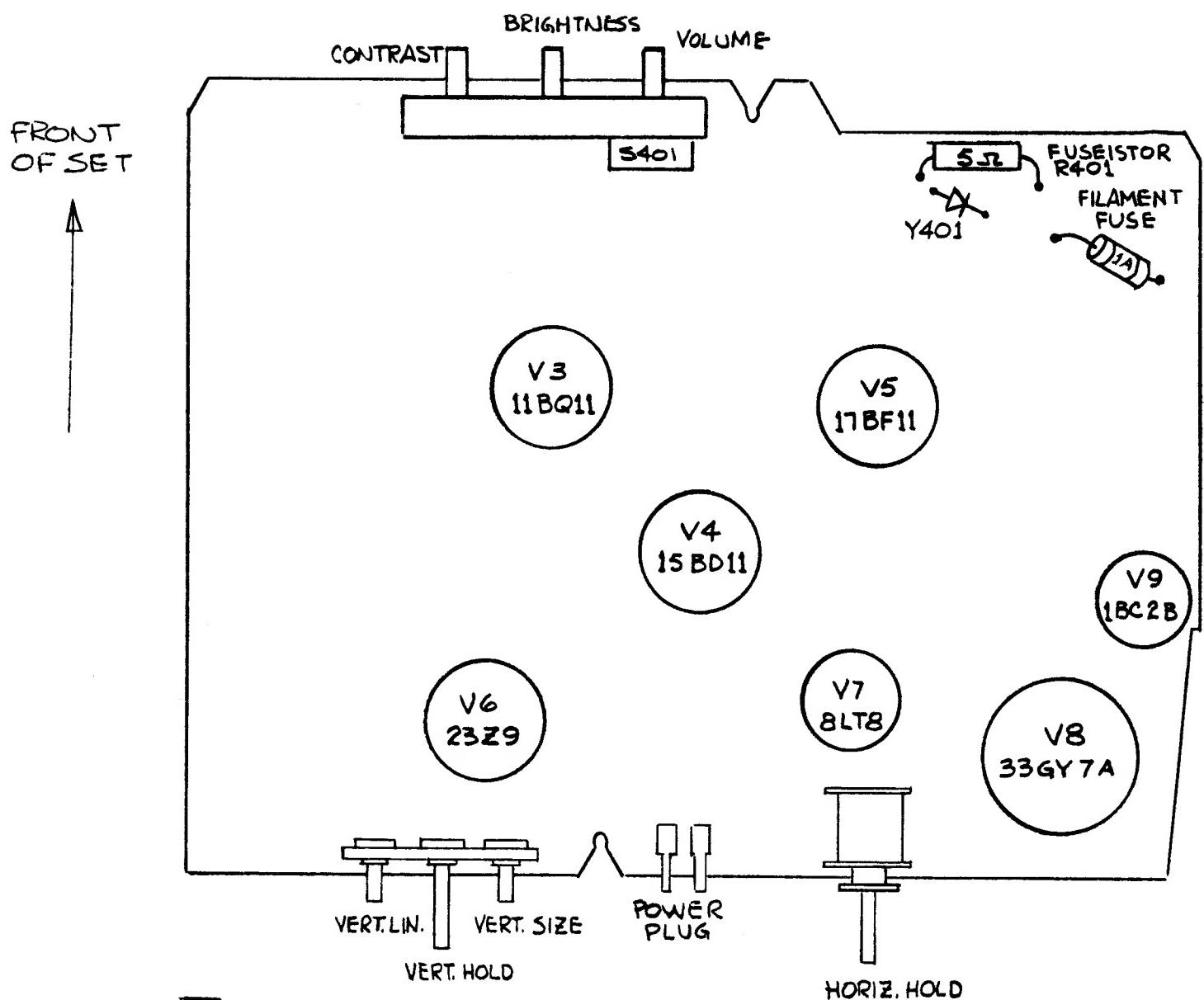
PLAYER ONE



NA 73-126

JOYSTICK CONTROL SERIES B
TWO PLAYER COMPUTER SPACE
NOT FOR RELEASE - NOTTING ALLOWED
USE ONLY
DRAWN BY ERIC J. SCHAFFNER 3/2/82
NOTTING ALLOWED
NOTTING ALLOWED

→ CAUTION: UNPLUG POWER AND DISCHARGE HIGH VOLTAGE ON
PICTURE TUBE BEFORE SERVICING!



SYMPTOM

1. NO VIDEO PICTURE OR POOR CONTRAST
SOUND AND BRIGHTNESS WORK PROPERLY
 2. NO SOUND OR LOW DISTORTED SOUND
 3. NO VERTICAL DEFLECTION
(BRIGHT HORIZONTAL LINE ACROSS SCREEN)
 4. NO PICTURE OR BRIGHTNESS
SOUND WORKS PROPERLY
 5. NO PICTURE, BRIGHTNESS OR SOUND
 - a. IF FILAMENTS ARE LIT :
(IF ONE FILAMENT IS LIT THAN ALL
FILAMENTS ARE WORKING PROPERLY)
 - b. IF FILAMENTS DO NOT LIGHT :

PROBABLE CAUSE

V4
CONTRAST TURNED DOWN

V5
VOLUME TURED DOWN

v6

IN ORDER OF MOST LIKELY:

V8, V7, V6.
LEAST LIKELY, BUT
POSSIBLE:

V9. PICTURE TUBE

OPEN FUSISTOR
(R401 5Ω)
OPEN RECTIFIER
(Y401)

BLOWN FILAMENT FUSE
OPEN TUBE FILAMENT
(EXCEPT V9)

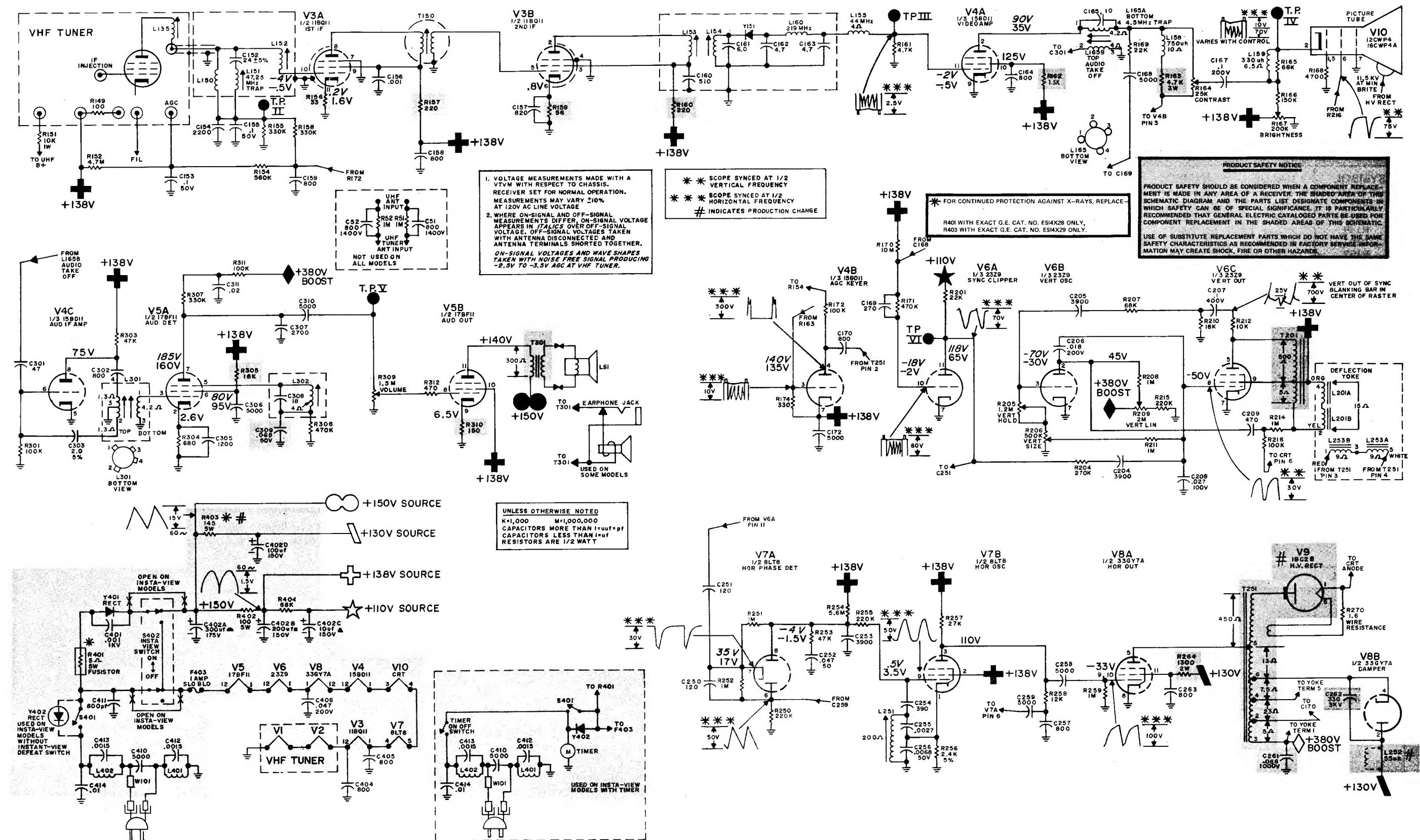
POWER PLUG

卷之三

TROUBLESHOOTING GUIDE

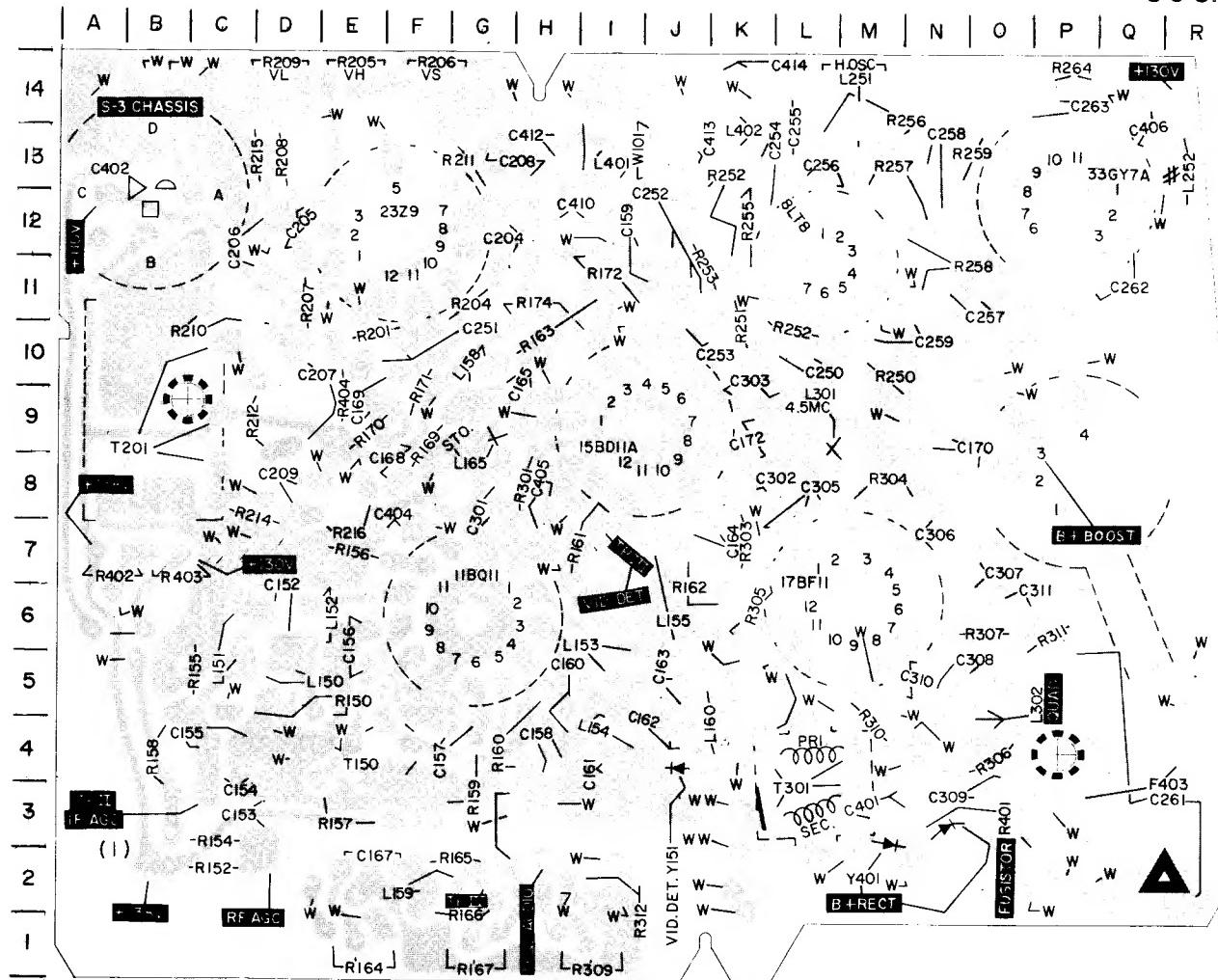
COMPUTER SPACE DISPLAY

1/4/72 Dabney -



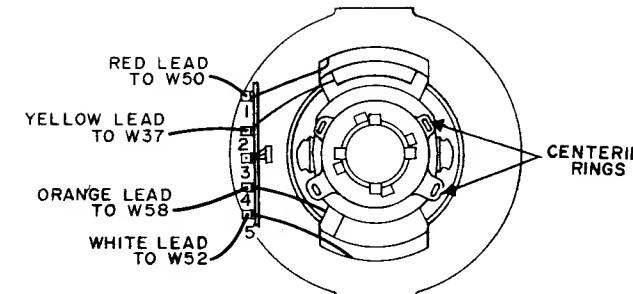
S-3-CHASSIS

S-3 CHASSIS

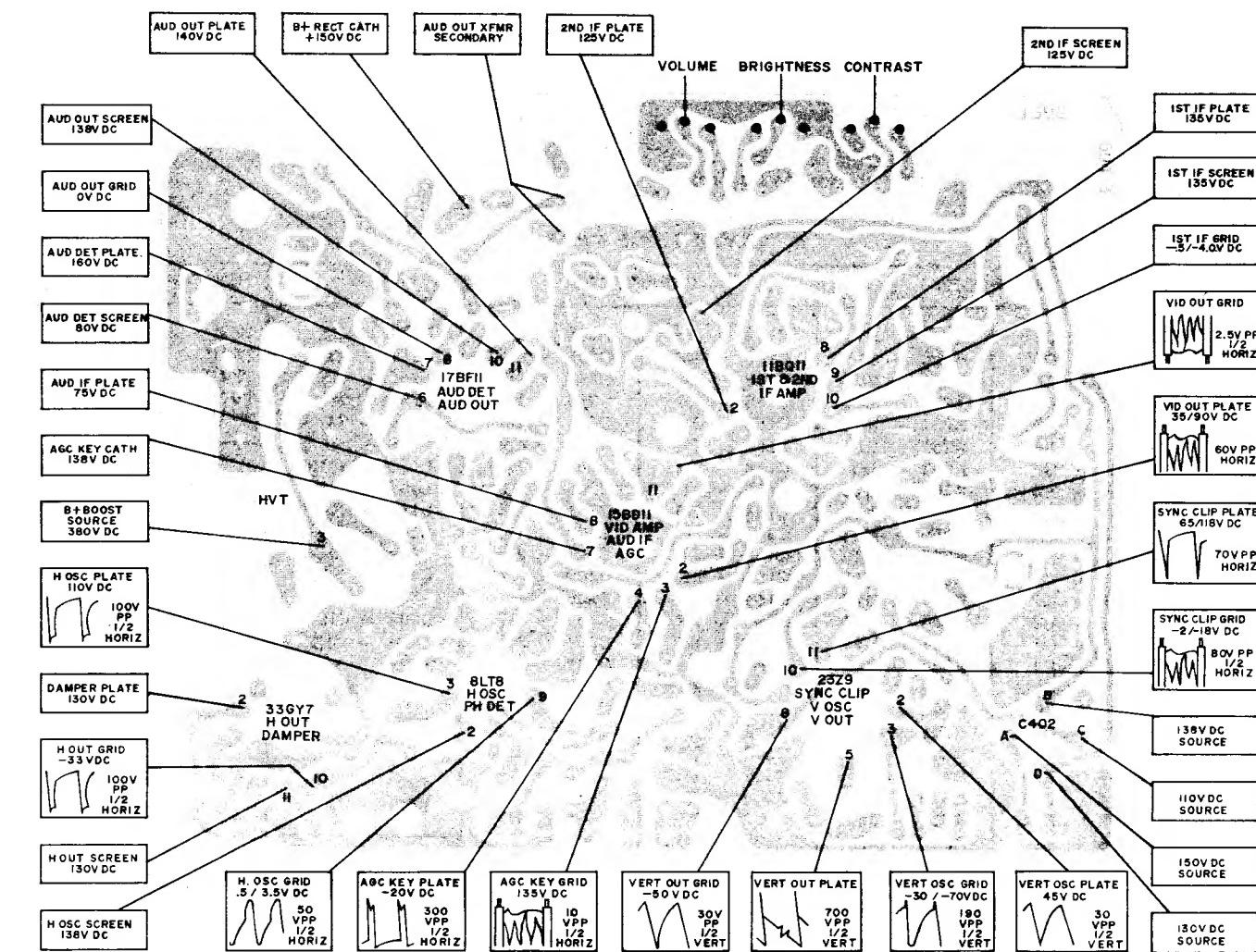


COPPER SIDE VIEW

| RESISTORS | | CAPACITORS | | COILS | | TEST POINTS | |
|------------|------------|------------|------------|------------|-------------|-------------|--|
| R152 - C2 | R214 - D7 | C152 - D6 | C255 - L13 | L150 - D5 | TP II - C3 | | |
| R154 - C3 | R215 - D13 | C153 - D3 | C256 - L13 | L151 - C6 | TP III - I7 | | |
| R155 - C5 | R216 - E8 | C154 - C4 | C257 - N11 | L152 - E6 | TP IV - G2 | | |
| R156 - E7 | R250 - M10 | C155 - C4 | C258 - N12 | L153 - I5 | TP V - H2 | | |
| R157 - E3 | R251 - K11 | C156 - E6 | C259 - M10 | L154 - I4 | TP VI - F10 | | |
| R158 - B4 | R252 - L10 | C157 - G4 | C261 - Q4 | L155 - J6 | | | |
| R159 - G4 | R253 - J12 | C158 - H4 | C262 - Q11 | L158 - G10 | | | |
| R160 - H4 | R254 - K12 | C159 - J11 | C263 - P14 | L159 - G2 | | | |
| R161 - I7 | R255 - K12 | C160 - H4 | C301 - G8 | L160 - K4 | TUBES | V3 - G6 | |
| R162 - J7 | R256 - M13 | C161 - I4 | C302 - K8 | L165 - G9 | V4 - J9 | | |
| R163 - H10 | R257 - M12 | C162 - J4 | C303 - K9 | L251 - M14 | V5 - M6 | | |
| R164 - E1 | R258 - N11 | C163 - J5 | C305 - L7 | L252 - R13 | V6 - E12 | | |
| R165 - G2 | R259 - O13 | C164 - J7 | C306 - N7 | L301 - M8 | V7 - L11 | | |
| R166 - G2 | R264 - Q14 | C165 - H9 | C307 - O7 | L302 - N5 | V8 - P12 | | |
| R167 - G1 | R301 - H8 | C167 - E2 | C308 - N5 | L401 - I13 | | | |
| R169 - F9 | R303 - K7 | C168 - F8 | C309 - O3 | L402 - K13 | FUSES | | |
| R170 - E9 | R304 - M8 | C169 - F10 | C310 - N5 | | | | |
| R171 - F9 | R305 - K6 | C170 - N9 | C311 - O6 | | | | |
| R172 - I11 | R306 - O4 | C172 - K9 | C401 - N3 | | | | |
| R174 - H10 | R307 - O6 | C204 - G12 | C402 - B12 | | | | |
| R201 - E10 | R309 - I1 | C205 - D12 | C403 - A14 | | | | |
| R204 - G11 | R310 - M4 | C206 - D12 | C404 - F7 | | | | |
| R205 - E14 | R311 - P6 | C207 - D9 | C405 - H7 | | | | |
| R206 - F14 | R312 - J2 | C208 - G13 | C406 - Q14 | | | | |
| R207 - D11 | R401 - O2 | C209 - D8 | C410 - I14 | | | | |
| R208 - D13 | R402 - B7 | C250 - L10 | C412 - H13 | | | | |
| R209 - D14 | R403 - B7 | C251 - F10 | C413 - J13 | | | | |
| R210 - C11 | R404 - E9 | C252 - J11 | C414 - K14 | | | | |
| R211 - G13 | | C253 - J10 | | | | | |
| R212 - D9 | | C254 - K13 | | | | | |



YOKE ASSEMBLY WIRING



TROUBLESHOOTING GUIDE – BOTTOM VIEW OF CIRCUIT BOARD

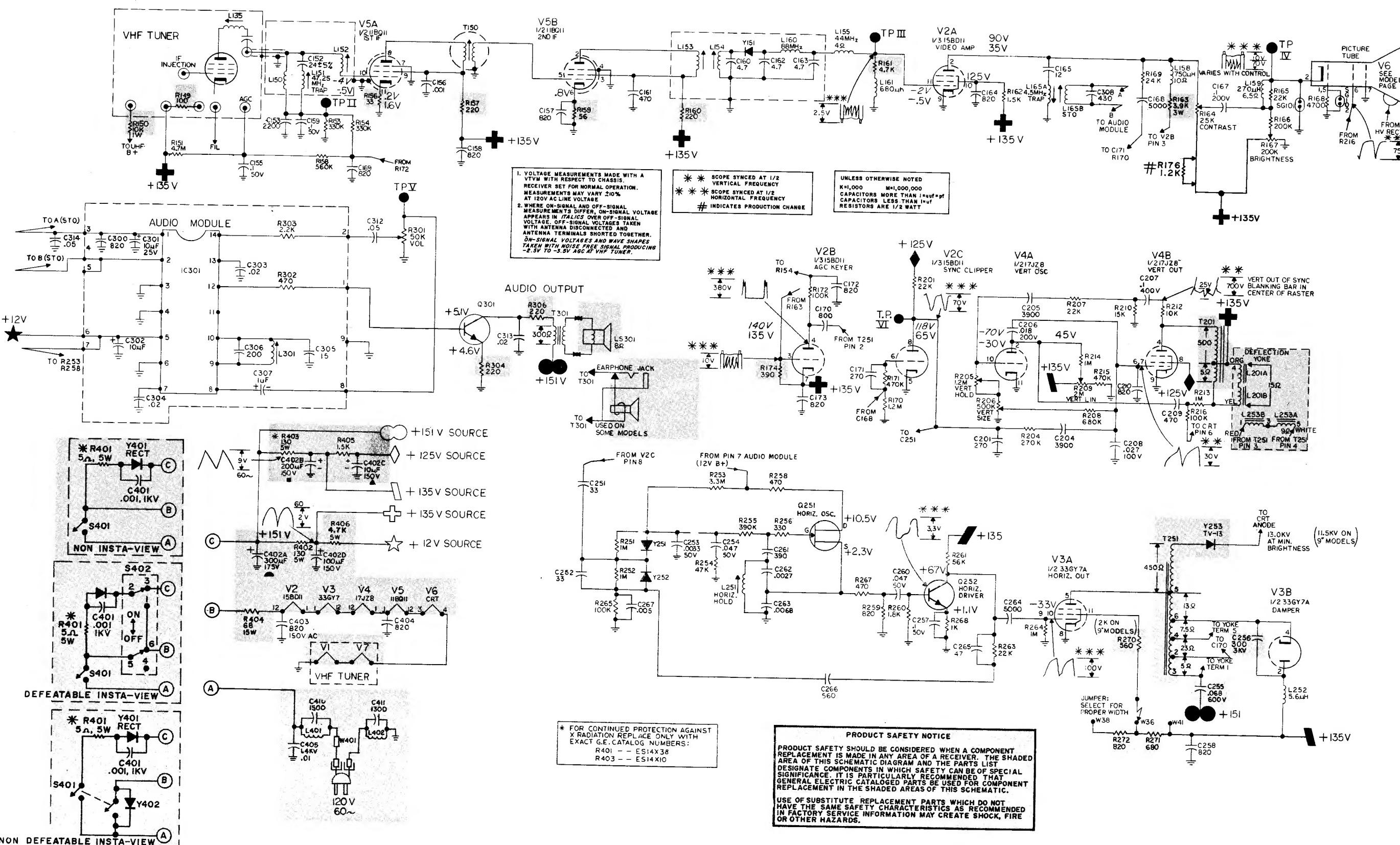
29-4202-71

5/71

VOL. H
(S-3) 35

(S-3) 3-6

GENERAL  ELECTRIC



9SF,12SF,&15SF CHASSIS SCHEMATIC DIAGRAM

9SF, 12SF, & 15SF CHASSIS

PRODUCT SAFETY NOTICE

PRODUCT SAFETY SHOULD BE CONSIDERED WHEN A COMPONENT REPLACEMENT IS MADE IN ANY AREA OF A RECEIVER. THE SHADED AREAS OF THIS PARTS LIST AND THE SCHEMATIC DIAGRAM DESIGNATE COMPONENTS IN WHICH SAFETY CAN BE OF SPECIAL SIGNIFICANCE. IT IS PARTICULARLY RECOMMENDED THAT GENERAL ELECTRIC CATALOGED PARTS BE USED FOR COMPONENT REPLACEMENT IN THE SHADED AREAS OF THIS PARTS LIST.

USE OF SUBSTITUTE REPLACEMENT PARTS WHICH DO NOT HAVE THE SAME SAFETY CHARACTERISTICS AS RECOMMENDED IN FACTORY SERVICE INFORMATION MAY CREATE SHOCK, FIRE OR OTHER HAZARDS.

COMMON RESISTORS

CARBON RESISTORS, 1/2 WATT, 5% UNLESS NOTED

No deviations from resistance and wattage values may be made for replacement items in shaded areas.

| SYMBOL | VALUE | SYMBOL | VALUE |
|--------|-----------------|--------|---------------------|
| R149 | 100, 1/2W, 10% | R213 | 1M, 10% |
| R150 | 10K, 1W | R214 | 1M, 10% |
| R151 | 4.7M, 10% | R215 | 470K, 10% |
| R153 | 330K | R216 | 100K |
| R154 | 330K | R251 | 1M, 10% |
| R156 | 33 | R252 | 1M, 10% |
| R157 | 220 | R253 | 3.3M, 10% |
| R158 | 560K, 10% | R254 | 47K |
| R159 | 56 | R255 | 390K, 10% |
| R160 | 220 | R256 | 330 |
| R161 | 4.7K | R258 | 470 |
| R162 | 1.5K | R259 | 820 |
| R165 | 22K | R260 | 1.8K, 10% |
| R166 | 200K | R261 | 56K, 10% |
| R168 | 4.7K | R263 | 22K |
| R169 | 24K | R264 | 1M, 10% |
| R170 | 1.2M, 10% | R265 | 100K |
| R171 | 470K | R267 | 470 |
| R172 | 100K | R268 | 1K |
| R174 | 390 | R270 | 560 (12&15" Models) |
| # R176 | 1.2K, 1/4W, 10% | R270 | 2K (9" Models) |
| R201 | 22K | R271 | 680 |
| R204 | 270K | R272 | 820 |
| R207 | 22K | R304 | 220 |
| R208 | 680K, 10% | R306 | 220 |
| R210 | 15K, 10% | R405 | 1.5K |
| R212 | 18K, 10% | | |

SPECIAL RESISTORS

| CAT. NO. | SYMBOL | DESCRIPTION |
|-----------|--------|-----------------------------|
| ES14X37 | R163 | 3.9K, 10%, 3W, Wirewound |
| * ES14X38 | R401 | 5 Ohms, 10%, 10W, Wirewound |
| ES14X10 | R402 | 130 Ohms, 5%, 5W, Wirewound |
| * ES14X10 | R403 | 130 Ohms, 5%, 5W, Wirewound |
| ES14X42 | R404 | 68 Ohms, 15W, 5% |
| ES14X43 | R406 | 4.7K, 5W, 10% |

9SF, 12SF, & 15SF CHASSIS REPLACEMENT PARTS LIST

POTENTIOMETERS

| CAT. NO. | SYMBOL | DESCRIPTION |
|----------|--------|--------------------------|
| ES49X2 | R205 | Vert. Hold - 1.2m, 30% |
| | R206 | Vert. Height - 500K, 20% |
| | R209 | Vert. Lin. - 2m, 30% |

CAPACITORS (CONT'D)

| CAT. NO. | SYMBOL | DESCRIPTION |
|----------|--------|--------------------|
| ES18X59 | C403 | 820pf, 20%, 150VAC |
| EP18X16 | C404 | 820pf, 20% |
| ES22X4 | C405 | .01uf, 150V |
| EP18X37 | C410 | 1500pf |
| ES18X60 | C411 | 1300pf, 20% |

COILS AND TRANSFORMERS

| CAT. NO. | SYMBOL | DESCRIPTION |
|----------|--------|---------------------------------|
| ES76X48 | | Yoke |
| ES36X115 | L150 | Coil, Link Shunt |
| ES36X117 | L151 | 47.25mc, Trap |
| ES36X754 | L152 | Coil |
| ES36X757 | L153 | Coil |
| ES36X116 | L154 | Coil |
| EP36X7 | L155 | Choke, 44mc |
| EU36X376 | L158 | Choke, 750uh, 7%, Peaking |
| ES36X118 | L159 | Choke, 270uh, 7%, Peaking |
| ES36X61 | L160 | Choke, 10uh, +20% |
| EP36X19 | L161 | Choke, 680uh, Peaking |
| ES36X119 | L165 | Coil-Sound Take Off |
| ET35X51 | L251 | Horiz. Osc. |
| EU36X536 | L252 | Choke, 5.6uh, 10% |
| ES36X28 | L401 | Choke |
| ES36X28 | L402 | Choke |
| ES36X23 | T150 | TRANSFORMER-Video IF |
| ES64X6 | T201 | Transformer-Vert. Output |
| ES77X16 | T251 | Transformer-HVT (12&15" Models) |
| ES77X17 | T251 | Transformer-HVT (9" Models) |
| ES64X13 | T301 | Transformer-Audio Output |

CAPACITORS
DISC CERAMIC, 10% 500V, UNLESS NOTED

| CAT. NO. | SYMBOL | DESCRIPTION |
|----------|--------|-----------------------|
| ET18X123 | C152 | 24pf, 5% |
| EP18X21 | C153 | 2200pf |
| EP25X29 | C155 | .1uf, 20%, 50V |
| EU22X117 | C156 | 1000pf, SSHK |
| EP18X16 | C157 | 820pf, 20% |
| EP18X16 | C158 | 820pf, 20% |
| EP25X29 | C159 | .1uf, 20%, 50V |
| ES18X501 | C160 | 4.7pf |
| EU22X90 | C161 | 470pf, SSHK |
| | C162 | 4.7pf |
| | C163 | 4.7pf |
| | C164 | 820pf, 20% |
| | C165 | 12pf |
| | C167 | .1uf, 20%, 200V |
| | C168 | 5000pf |
| | C169 | 820pf, 20% |
| | C170 | 820pf, 20% |
| | C171 | 270pf, N750 |
| | C172 | 820pf, 20% |
| | C173 | 820pf, 20% |
| | C201 | 270pf, N750 |
| | C204 | 3900pf |
| | C205 | .0039uf |
| | C206 | .018uf, 200V |
| | C207 | .1uf, 400V |
| | C208 | .027uf, 100V |
| | C209 | 470pf |
| | C210 | 820pf, 20% |
| | C251 | 33pf, 5% |
| | C252 | 33pf, 5% |
| | C253 | 3300pf, 50V |
| | C254 | .047uf, 20%, 50V |
| | C255 | .068uf, 600V |
| | C256 | 300pf, 4 KV |
| | C257 | .1uf, 50V |
| | C258 | 820, 20% |
| | C260 | .047uf, 20%, 50V |
| | C261 | 390pf |
| | C262 | 2700pf, 125V |
| | C263 | .0068uf, 50V |
| | C264 | 5000pf |
| | C265 | 47pf, 20% |
| | C266 | 560pf |
| | C267 | 5000pf |
| | C308 | 430pf, 5%, 125V |
| | C312 | .05uf, 50V |
| | C313 | .02uf |
| | C314 | .05uf, 50V |
| | C401 | 1000pf, +80-20, 1000V |

ELECTROLYTIC CAPACITORS

| CAT. NO. | SYMBOL | DESCRIPTION |
|----------|--------|-------------|
| ES31X254 | C402A | 300uf, 175V |
| | C402B | 200uf, 150V |
| | C402C | 10uf, 150V |
| | C402D | 100uf, 150V |

TRANSISTORS

| CAT. NO. | SYMBOL | DESCRIPTION |
|----------|--------|-------------------------|
| ES15X92 | Q251 | Transistor-NPN, Silicon |
| ES15X93 | Q252 | Transistor-NPN, Silicon |
| EP15X16 | Q301 | Transistor-PNP, Silicon |

MISCELLANEOUS

| CAT. NO. | DESCRIPTION |
|----------|----------------------------------|
| ES2X62 | BRACKET-HV Rect., Plastic |
| ES1X228 | BOLT—"U" HV Mtg. |
| ES2X60 | CLIP-Resistor Retainer, R149 |
| ES12X137 | CORE-HV |
| EP10X52 | FUSE-4 Amp, 250V, Fast Blo, W401 |
| ES75X1 | MODULE-Audio |
| ES8X6 | PLUG-Phone Type, To Tuner |
| ES69X10 | SHAFT-Horiz. Hold Control |
| ES41X4 | SPARK GAP-1500V, SG102 |
| ES34X14 | SOCKET-Right & Left Module |
| ES34X19 | SOCKET-V2, V5 |
| EU34X116 | SOCKET-V3, V4 |
| ES34X37 | SOCKET-7 Pin, CRT |
| ES3X7 | SPACER-Coil |
| ES8X123 | TERMINAL-Interlock, Small |
| ES8X124 | TERMINAL-Interlock, Large |